When Man Made Friends With the Cow, He Took the First Step Forward in Human Nutrition

THE MOST NEARLY PERFECT FOOD

The Story of Milk

BY

SAMUEL J. CRUMBINE, M.D.

General Executive American Child Health Association
Formerly State Health Officer of Kansas

AND

JAMES A. TOBEY, Dr. P. H.

Author The Quest for Health, The National Government and
Public Health, Public Health Law, etc. Formerly
Secretary National Health Council

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PREFACE

Books on nutrition are numerous and so are books on dairy science. All of them contain much material on milk, but since there was no modern text devoted entirely to a popular presentation of all of the interesting phases of this one nearly perfect food, the authors felt justified in preparing this volume on the history, production, practical use, sanitation, and dietary functions of milk and its products.

Though designed primarily for the lay reader, the authors have endeavored to include facts which will make the book useful and informative to teachers and students of home economics, dietetics, agriculture and dairy science, medicine, and public health, particularly child hygiene and school hygiene.

Acknowledgments are due to a number of eminent scientists who have been good enough to read and criticize various chapters, though the blame for any errors or faults belongs only to the authors. Appreciation for such assistance is, therefore, gratefully extended to Mrs. Helen R. Baldwin, Miss Margaret M. Edwards, Dr. Louis I. Harris, Dr. F. D. Holford, Dr. C. W. Larson, Mr. W. H. Marcussen, Dr. C. D. Pearce, Dr. Frank E. Rice, Prof. Henry C. Sherman, and Dr. H. E. Van Norman.

SAMUEL J. CRUMBINE
JAMES A. TOBEY

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country reaches the century mark and most of those who do have long since ceased to derive pleasure from living Yet there has been a considerable advance in centenarianism, for it has been asserted that approximately an hundred years ago the number of centenarians was only about one-tenth what it is at present Thus, in France in 1836 there were only 146 such old people, or one to 220,000 of the population

In spite of the wailings of a few professional sceptics, who disparage the efforts of sanitary science to extend the span of useful life and who assert after a superficial examination of the data that the duration of life is immutable, there seems no doubt but that longer life is possible When it is also better life, longevity is eminently desirable Activities which merely increase the number of bed ridden senescent persons who are a burden to others are perhaps of questionable value, but when life is not only prolonged but maintained in an efficient manner, then life extension is indeed worth while

Two thousand years ago a Roman philosopher, one Marcus Valerius Martial, remarked that, "It is not life to live, but to be well " In this endeavor to prolong human life, the chief aim is, and should be to defer old age, to extend the prime of life, and to continue the period of possible service and utility That goal certainly can be achieved, if the scientific

evidence now at hand is reliable, as it unquestionably is. Our purpose is to discuss some of the acknowledged ways and means whereby this feat may be accomplished. First, however, let us consider further this interesting progress in transforming the measure of life.

THE CHANGING SPAN OF LIFE

Although in ancient Egypt there was probably attained a duration of life which averaged only 30 years, the span became even less *in the Middle Ages*, that dark period of human history when sanitation was forgotten and plagues and pestilences were rampant. Then, man was fortunate to average 20 years of human life. This does not mean, of course, that there were not old people, for when we speak of the "average" length of life or of the "expectancy" of life, we are considering the span of the people as a whole. A high infant mortality, such as there has always been until comparatively recent years, and a high mortality in early adult life, such as was characteristic of the days before Pasteur, are factors which bring down the average. The fortunate longevity of a few was not sufficient to bring it up.

Most of the notable increase in the extension of life has occurred within the last half century, a period which has witnessed the birth and development of preventive medicine and sanitary science. Up to a

decade or two ago what increase there was had been very gradual, but in recent years it has been quite rapid For figures as to the duration of life in the sixteenth century and the two centuries following, we have to go to the vital statistics of Geneva, from which we learn that the expectation of life in the sixteenth century was only 21 years, but that it increased to 26 years in the seventeenth century, and to 34 in the eighteenth century

The two hundred years before the foundations of the modern science of public health were laid thus witnessed an increase in the length of life of only 13 years Compare this with the period from 1900 to 1928, when almost the same number of years have been added to the average life span in the United States alone

From the eighteenth to the twentieth centuries we have to depend upon the staid old commonwealth of Massachusetts for our data, for that one of our states seems to have kept the only dependable life tables In 1789 in Massachusetts the expectation of life was 35 years, about the same as in Geneva By 1890 it had increased to 43 and in 1897 to 45 years After that we have more comprehensive figures, compiled by the United States Bureau of the Census In the states of the so called registration area, where the statistics are accurate enough to be dependable, the expectation of life in 1900 was 49 years Advanced

as is our vaunted civilization it is a significant fact that our registration area in 1929 comprised only about 90 per cent of our country for in some sections vital statistics have not yet become reliable

The turn of the century has seen the greatest advancement in the length of life Although the average life span was only 51 years in 1910 it had leaped to 55 in 1920 Today (1929) it is about 58 years in the United States That figure is greater than in most other countries but we are still behind a number of other nations notably New Zealand Australia, Holland and the Scandinavian lands all of which are from one to six years ahead of us

Life is longest in New Zealand It is shortest among primitive peoples where the modern science of public health is unknown or as yet has been unable to make progress Thus in India the span of life has been unchanged at about 23 years for innumerable centuries No one knows what it is in China for instance, but as in most parts of the Orient where nutrition is poor and other conditions are unfavorable, it is very low

THE CAUSES OF THE CHANGE

Many factors have been instrumental in bringing about this *remarkable increase in the span of life* Natural selection has had something to do with it, better economic conditions have undoubtedly made

their contribution When all is said and done, however, the bulk of the credit goes to sanitary science, for it is the mastery of man over the microbe which has done the most to extend human life

Consider for a moment some of the victories over diseases There is tuberculosis, the death rate of which in this country was nearly 200 per 100,000 population in 1900 Today it is less than 90 Biology, of course, has had something to do with that reduction, but control of the environment has had even more Better living conditions, more adequate supervision of cases, more expert medical care, and improved nutrition, have all played their part The role of better nutrition in preventing disease and helping to defer old age will soon have expository attention in this book

The achievement of the sanitarian is emphasized by the conquest of typhoid fever From a death rate of about 36 per 100,000 in 1900, the mortality from this disease has been brought to less than 7 at present The decline in infant mortality is another indicator of results attained by modern public health, for it is estimated that more than 250,000 infants are alive today who would not be alive if the high infant mortality of 1900, some 170 deaths under one year of age per 1000 live births, still prevailed That it does not prevail and is now half that figure can be chalked up as one of the accomplishments of modern preventive medicine

fewer children are succumbing, and fewer young adults are cut off prematurely, so that the general average is raised. A person who has reached the age of 58 now has a further expectancy of life of about 16 years, according to authentic life tables.

More young people are reaching middle age and old age, but there has been only a slight increase in the number of middle aged people who are attaining old age. Only about one third of the population now reaches 65 years of age. It is, of course, advantageous not to die of enteritis in infancy, of diphtheria in childhood, or of smallpox, typhoid fever, or tuberculosis somewhat later in life. Sooner or later, by means of periodic health examinations, by more favorable nutrition, and in other ways, the organic diseases of more advanced adult life will also be reduced. Let us examine in more detail one of the most important of the many factors which contributes to longevity and to felicitous living.

NUTRITION AND LONGEVITY

If you delve into history you will find that certain races have been more vigorous and long lived than have other peoples. If you go further and search the cause of this phenomenon you will ascertain that the food of the more virile stock has invariably been superior to that of the less robust and the less healthy. The modern science of nutrition has provided a reason,

for due to brilliant research of the last two decades, it is now well known that what we eat or do not eat has a definite effect on our salubrity and even on our tendency to live long

Although science has confirmed this fact, the idea is not new, for human experience has shown that it has been so almost from the dawn of history As pointed out by Prof E V McCollum of Johns Hopkins University, the pastoral peoples of the world who have had possession of many dairy animals and whose diet has consisted largely of the products of those animals have always displayed the finest physical development They have done so "without exception," says Professor McCollum [4]

In a remote part of the Himalayas is an isolated race with magnificent physique the members of which seem to have found that elusive fountain of youth, for they retain until late in life the characteristics of youth Since gland transplantations have not yet made their way into this secluded part of the world, the explanation for this unusual virility and fertility is primarily one of diet As reported by Dr Robert McCarrison of the British Medical Service, these people subsist on a frugal diet, consisting mostly of goat's milk and vegetables [5] Another British scientist in India, Dr D McCay, has found that the pastoral

[4] McCollum E V and Simmonds N The Newer Knowledge of Nutrition (3rd ed) Macmillan 1925

Indians of the few good dairy regions of that country are always vastly superior to the more numerous natives who live only on cereal grains

A striking example nearer home brings out the significance of diet to health When the American Revolution occurred, a number of the English colonists chose to remain loyal to the mother country, even though the maternal care had been somewhat lacking in political nourishment Some of these colonists departed for Canada, while their cousins migrated to the Bahamas Both groups were of the same stock and their characteristics were then similar, but today a vast difference is observed in their descendants The Canadians are an active, virile, upstanding people whose mental alertness is shown, among other ways, by the fact that they are most emphatic in declaring, with sidelong glances at their friendly neighbor to the south, that they expect to be perpetually independent The Bahamians are said to be distinctly an indolent and easy-going group

Now this dissimilarity may be attributed to marked climatic differences and, in fact, has been so argued by Prof Ellsworth Huntington, an American geographer On the other hand Professor McCollum calls attention to the fact that besides the cold and invigorating climate of Canada there is the more important feature that the Canadian diet is rich in milk, butter, cream, and cheese, in addition to cereals,

legume seeds tubers, and meats The Bahamians in their enervating temperature partake of fruits and certain vegetables, but seldom use dairy products Professor McCollum properly suggests that, "People will feel very different on these two types of diets"

A climate which is continuously hot does not seem to have a deleterious effect on physical welfare when nutrition is good Arabia is an inferno, considerably worse with respect to temperature than the Bahamas, but the Arabs now have and, so far as observed, always have enjoyed a most excellent physique Even Napoleon's surgeon general, on the great commander s Egyptian campaign, described these lean, sinewy hawks of the desert as more perfect in physical structure than most Europeans

There is an Arabian proverb to the effect that he who has health has hope and he who has hope has everything The Arabs are fortunate in that they have something besides hope which contributes to their health and that something is milk According to various writers, the fare of the pastoral Arab is mostly milk, supplemented with only moderate amounts of meat, cereals, and dates The milk is that of goats, camels, and sheep and, because of the intense heat, is soured at once and eaten in the form of curds

Throughout wide areas in Asia milk is also the staple article of diet of many races who lead a precarious

existence The Mongols must live on milk or starve They do not starve, but are a wiry and vigorous, though thin, race The Tartars at times live almost exclusively on mare's milk and thrive on it Marco Polo on his peregrinations was much impressed by a milk wine which had been manufactured by the Tartars since the thirteenth century

The dominant and aggressive peoples of the world have always been those whose nutrition has been of the best It is related of David that he was carrying ten cheeses for the nourishment of his cohorts when he met and conquered the redoubtable Goliath The conquerors have always been users of dairy products in abundance, and not of grasses and grains, nor of meat The beef eaters, so called, of England have also been drinkers of milk as well as of some more potent beverages The Scandinavian countries, where the span of life is so much greater than ours, have always been noted as dairy countries, and the same is true of Holland, another country where the average life is longer

Ask any scientist what is the national drink in the United States today and in spite of the reputed popularity of various forbidden beverages, he will answer—milk There has been a tremendous increase in the consumption of milk and the use of dairy products in this country during the last decade and this has unquestionably been one of the factors in adding to the marked increase in our span of life

SCIENTIFIC EVIDENCE

Human experience is always worth more if it is supported by scientific investigation What appears to be so is sometimes not so, for mere observation often gives rise to fallacious deductions The role of nutrition in the promotion of health is, however, no longer a matter of supposition or mere speculation, for a legion of investigations by eminent scientists have removed all doubts on that score and have proven conclusively that an adequate diet is essential to proper growth, general physical welfare, and good health

That the right food can actually extend life has been demonstrated by a series of brilliant and interesting investigations conducted by Prof Henry C Sherman of Columbia University in New York For nearly ten years in his laboratories feeding experiments have been under way on that well known laboratory animal the white rat While a rat as Dr L Emmett Holt once remarked is not a baby, and probably never will be, the results of these studies unquestionably also hold good for human beings The life of the white rat is relatively short and his nutritional foibles resemble those of man, so that studies on these docile rodents offer material of real scientific value

When Professor Sherman began these experiments in 1919, he tried feeding his animals on various food-

stuffs, but every single article of diet failed to nourish until milk was tried An adequate fare was eventually determined to be one containing five-sixths powdered whole wheat and one sixth powdered milk, with a little salt, and plenty of distilled water Rats would grow and reproduce on this fare and in the next ten years more than twenty one generations of them were raised on it

Now for the difference between an *adequate* and an *optimum* diet When the proportions of milk in these regimens was increased, some startling results were obtained By doubling the amount of whole milk powder in the diet of his rats, Professor Sherman found that they grew more rapidly, gained more weight in proportion to the food consumed, attained to greater sizes, matured earlier, were able to reproduce for longer periods, had greater success in rearing their young, and, finally, the offspring themselves grew more efficiently

These evidences of improved nutrition were confirmed by repeated experiments, so that in 1928 Professor Sherman could report to the National Academy of Sciences,[5] "We have recently completed a somewhat extensive experiment in which the influence of a single change in the food supply upon the

[5] Sherman H C and Campbell, H L The Influence of Food Upon Longevity *Proceedings, National Academy of Sciences*, vol 14, no 11, pp 852–855, November 1928

longevity of rats of identical heredity, maintained under conditions uniform in all other respects, appears to have been fully demonstrated"

In this important study, about 400 rats were kept in approximately equal numbers on the two different dietaries The result was that the group getting the higher proportion of whole milk powder showed a longevity exactly ten per cent better than the group getting only half as much milk, and this applied to both males and females The acid test of statistical analysis indicated that there was not more than one chance in a hundred for error due to accident

Translated into human experience, this notable study indicates that six years at least could probably be added to the span of human life by means of optimum nutrition This prolongation of life is significant enough, but even more momentous is the fact brought out by these tests that the prime of life is extended in both directions by means of a favorable diet Not only is there earlier maturity, but old age is deferred in the same individuals These results confirm those of Professor McCollum, who has pointed out that the onset of senility may be postponed by correct nutrition

THE ELIXIR OF LIFE

About twenty years ago Prof Eli Metchnikoff, the famous bacterologist, wrote a somewhat ponderous

volume on the prolongation of life. In it he hazarded the opinion that human life could just as well average 120 years, and he cited instances of many persons who had attained to the distinction of being centenarians or had reached even greater ages. Thus, there was Marie Priou, who died in 1838 at the alleged age of 158 and who, incidentally, subsisted during the last ten years of this extraordinary life entirely on *cheese and goat's milk. Another individual, Nicole* Maro was said to have lived to be 110 on a diet of bread and milk.

Although Metchnikoff gave due credit to general hygiene and sanitation as a factor in extending life, he was particularly impressed with the fact that longevity was a characteristic in numerous places where *soured milk formed the pièce de résistance* of the diet. Thus, in the Balkans, where such food is and always has been extremely popular, there were claimed to have been more than 5000 centenarians in 1896. If each of these cases had been carefully investigated, it would probably have been found that the supposed great age of many of them had been exaggerated. The evidence is conclusive, however, that a ripe old age is frequent in the Balkans among the pastoral peasants who consume great quantities of milk products.

Metchnikoff decided that one of the principal ways to increase longevity was to take into the human

system quantities of an organism which soured milk called the *Bacillus Bulgaricus*. We know today that it is not this particular microbe which is effective in the intestinal tract, but another, the acidophilus bacillus, which had actually been discovered prior to the bulgaricus. Milk contains lactose which forms a favorable medium for the development of the acidophilus bacillus which, as a consequence, is cultured in milk and fed in this way.*

From the evidence at hand today, it would seem that the explanation of the long lives observed by Metchnikoff in the Balkans and elsewhere could be attributed not so much to the bacillus which sours milk as to the beneficial effects of the milk itself. Soured milk still retains the important vitamins, the necessary minerals, and the other elements which perform the physiological miracles resulting in improvement in the physical welfare of man.

Milk has been called by its enthusiastic proponents the modern elixir of life. Without dealing in superlatives, it can indeed be said that milk is the most nearly perfect of human foods for it is the only single article of diet which contains practically all of the elements necessary to sustain and nourish the human system.

* See p. 193

MODERN ALCHEMY

Soothsayers of old and alchemists of medieval sought eagerly for an elixir of life They hop

Sweet Summer Boarder Wh[illegible] k[illegible]d of a cow [illegible] Jersey?
Farmer: No [illegible] that [illegible] Holstein
S S B I see And have you any of that new breed—the Acidoph[illegible]

"HAVE YOU ANY ACIDOPHILUS COWS?"
Copyright 1928, Life Publishing Company

their labors to discover a concoction which imbibed would give eternal life A positive was claimed by many ancient charlatans Cagli

the prince of quacks, was positive in declaring that he possessed the secret He died before he revealed it Metchnikoff, who was no mountebank, thought he had found the elusive key to longevity Even today there are those who advance weird schemes, frequently using glandular extracts and other chicanery, to support claims that a new elixir of life is at hand

There is, of course, no single elixir of life We do not propose milk for that category, but merely point to it as one of the many factors which conduces to a hale and happy long life A man might consume huge quantities of milk throughout his existence and still die young because of deliberate or accidental ignoring of other established rules of hygiene and sanitation, or because of a particularly poor heredity Nutrition itself is only one of the elements in longevity and milk *is only one of the elements in nutrition,* even though dairy products are conceded to be the basis of an adequate and well balanced diet

There is no modern philosopher's stone, but it is an interesting fact that life, though not human life, has in reality been prolonged indefinitely A scientist at Yale found no natural death in a culture of Paramecium, a single celled animal organism at the lowest scale of life He has kept it going for 8500 generations, which is said to be equivalent to 250,000 years of human life At The Rockefeller Institute in New York, Dr Alexis Carrel has kept alive for many years

the cells from the heart of a chicken embryo, having accomplished this astounding feat by the simple procedure of cleansing this material regularly of the poisons produced in the life process, and by protecting *the cell against infection and insuring it ample* nourishment

A continuance of these precautions should maintain life in these cells forever, though the endeavor will eventually have to be turned over to Dr Carrel's successor, for human life will not become immortal *in time for him to complete the job* *Perhaps, after* all, as has been asserted, death is an accident rather than a fixed and unavoidable event, but whether it is or not, these interesting biological experiments do not now and may never have a practical application with respect to human life Death can not be prevented, but there *is no reason, except chance,* why *it can not* often be postponed

Any discussion of the prolongation of life and the postponement of death is likely to get on to the dangerous ground trodden in the past by mystics and charlatans, especially if care is not taken to avoid *superlatives and hyperboles When the evidence is* marshalled, however, it seems well established by a preponderance of acceptable testimony that life has actually been extended, that it is now increasing at a greater rate than ever before in history, and that, through the triumphs of modern medical science and

the newer science of public health, brilliant possibilities are ahead

Since proper nutrition plays such a significant rôle in the game of life, it is worth while to consider this subject in some detail Since pure milk is the one nearly perfect food, it is eminently desirable for all people to have practical and useful information about this most important of human victuals That is not alchemy, it is sound common sense

CHAPTER II

THE ADEQUATE DIET

The modern rules for right eating are relatively simple, despite the fact that a vast amount of intricate research has been necessary for their formulation. Due to the notable investigations in the field of human nutrition during the last twenty years, there now exists accurate and useful information regarding food and health. In order to make this knowledge more readily available and to indicate more clearly how milk fits into the nutritional scheme as the most nearly perfect food, it is desirable to present here a practical description of the proper uses of food and the constituents of a well balanced diet.

THE WELL BALANCED DIET

Foods are now so numerous that it is possible to secure all kinds and combinations in the diet. With a little wisdom and care it is comparatively easy to get the well balanced diet necessary to good health. A well balanced diet is one which not only nourishes the individual and thus contributes to his health and happiness, but it is one which aids in proper growth when growth is needed, helps to develop a favorable resistance to disease, and assists in promoting and maintaining a long and enjoyable life.

A practical knowledge of these dietary facts is of great personal significance to the individual. A well balanced diet is, moreover, also of importance to the race, for it is one which aids us to transmit vigorous health to our descendants. By attention to our own nutritive needs we are helping to make it possible for our posterity to be well born.

A diet to be complete and satisfactory from the standpoint of human nutrition must fulfil these essential requirements:

1. It must yield adequate fuel or energy value to meet the daily needs of the human machine.
2. It must contain suitable protein and other nutrients to build, replace, and repair bodily tissue in the most effective manner.
3. It must possess minerals to assist in various necessary bodily processes.
4. It must have water to act as a solvent, a carrier and regulator.
5. It must be abundantly supplied with the vitamins which are essential to growth, reproduction, good health, and the proper functioning of the human system.
6. It must be digestible.

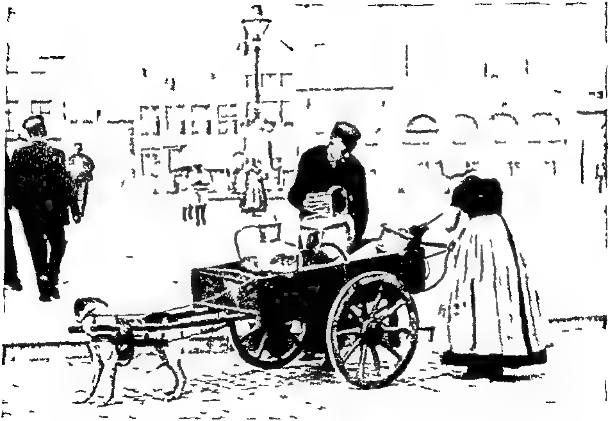
The well balanced diet can and should likewise be palatable, for foods are none the less appetizing and attractive because science has shown them to be nutritious and beneficial to health when used in certain combinations. There is, furthermore, nothing very complicated about these requirements. One of the simplest rules to follow is to make certain that the daily diet contains liberal amounts of milk or dairy

Having disposed of energy, nutrients, and vitamins satisfactorily, it can justifiably be asserted that among the other qualities of this illustrative diet are the fluid content, the proportion of raw foods, a good color scheme, flavor, and digestibility No food in this collection, if properly cooked, would cause indigestion in any normal individual Merely writing about such a savory diet as this stimulates gustatory sensations, reading about it may do as much

THE FUEL OF THE HUMAN MACHINE

The human body is a mechanism which must have plenty of fuel, although the exact quantity depends upon the size, sex, age, temperament, activity, and other characteristics of each individual machine As fuel for the human mechanism, food is burned, chiefly in the muscles, to produce the energy needed for bodily activity This combustion is measured in terms of calories, a term derived from the French word meaning "heat"

All foods contain the chemical elements carbon, hydrogen, and oxygen in various combinations The so called carbohydrates, such as sugar and the starches, have only these three elements The fats have these same elements, but arranged in a different way The proteins, on the other hand, have not only carbon, hydrogen, and oxygen, but also nitrogen and a small amount of sulphur, these two elements,



Fu g Calouay

Dispensing Milk in Holland

especially nitrogen being particularly useful in tissue building. A dozen or more minerals, of which the most important are calcium, phosphorus, iron and iodine, are also necessary in nutrition, and these are found in various foods in addition to the carbohydrates, fats and proteins.

The number of calories secured from each article of food now available for the human dietary has been worked out by the chemists. Thus a pint of milk gives 337 calories, a medium sized potato about 100, and a medium sized orange about 88. Fat is the most concentrated form of fuel food, though the carbohydrates are, in general, the most useful for the purpose. A cubic inch of butter, which is mostly fat, yields 100 calories, and a teaspoonful of cane sugar, which is pure carbohydrate, gives about 20 calories. A quarter of a pound of American cheese, which is largely protein and fat, has nearly 500 calories. In the accompanying table (1) are shown the calorie values of various foodstuffs.

The calorie requirements of the individual vary according to his build, age, mode of life, and other factors. A person whose occupation is clerical, and who spends most of the day sitting at a desk, may not need more than 2000 or 2800 calories, depending upon his or her size, age, race, etc. On the other hand, a day laborer whose work requires muscular strength and continuous physical activity may need

TABLE 1

THE ENERGY VALUES OF SOME COMMON FOODSTUFFS IN CALORIES*

FOODSTUFF	CALORIES IN 1 POUND	FOODSTUFF	CALORIES IN 1 POUND
Meats		Dairy products	
Pork chops	1530	Milk	314
Sirloin steak	1099	Cheese (American)	1990
Leg of lamb	876	Eggs	672
Chicken	493	Butter	3491
Bacon	2840	Root vegetables	
Cereals		Potatoes (white)	378
White flour	1623	Carrots	204
Corn meal	1620	Beets	209
White bread (average)	1182	Turnips	178
		Green vegetables	
Dried seeds		String beans	184
Beans, navy	1565	Chard	173
Beans, Lima	1586	Cabbage	143
Peas	1611	Spinach	109
Fish		Asparagus	100
Mackerel	629	Celery	84
Salmon	582	Cucumbers	79
Blue fish	402	Fruits	
Flounder	282	Bananas	447
Cod	209	Apples	285
Oysters	228	Oranges	233
		Grape fruit	235

* Walter H Eddy Nutrition, p 10 Williams & Wilkins, Baltimore 1928

as many as from 4000 to 6000 calories The general average is from 2400 to 3300 Children often

require more calories than adults, because of their greater activity. Their needs are shown in table 2.

When a person gets an excess of calories, for his

TABLE 2

TOTAL CALORIES PER DAY FOR CHILDREN OF DIFFERENT AGES*

AGE	CALORIES PER DAY	
	Boys	Girls
years		
Under 2	900–1200	900–1200
2– 3	1000–1300	980–1280
3– 4	1100–1400	1060–1360
4– 5	1200–1500	1140–1440
5– 6	1300–1600	1220–1520
6– 7	1400–1700	1300–1600
7– 8	1500–1800	1380–1680
8– 9	1600–1900	1460–1760
9–10	1700–2000	1550–1850
10–11	1900–2200	1650–1950
11–12	2100–2400	1750–2050
12–13	2300–2700	1850–2150
13–14	2500–2900	1950–2250
14–15	2600–3100	2050–2350
15–16	2700–3300	2150–2450
16–17	2700–3400	2250–2550

* Gillett, L. H. Food Allowances for Healthy Children. New York Association for Improving the Condition of the Poor. 1917.

station of life, this means, of course, that he is using too much or too rich food, a fact which is frequently manifested in overweight or obesity.[1] Conversely,

TABLE 3

LIMITS OF OVERWEIGHT CORRESPONDING TO VARIOUS MORTALITY RATIOS*

Directions Use for males, for females deduct 10 15 per cent Drop fractions of an inch, ½ inch or less, over ½ inch, use next inch Overweights whose abdominal girth exceeds the *expanded chest girth should receive* additions to mortality ratios as per tabulation at end of this table

HEIGHTS	MORTALITY RATIOS	WEIGHTS ACCORDING TO AGE PERIOD								
		20–24	25–29	30–34	35–39	40–44	45–49	50–53	54–56	57–59
5 ft, 1 in	100	144	137	131	129	128	130	131	130	129
	110	160	149	138	138	140	140	142	142	142
	120	166	159	147	149	150	151	151	152	152
	125	167	160	154	152	152	154	156	157	157
	135	173	166	161	159	159	161	162	163	163
	140	177	170	165	162	163	163	166	166	168
	150	182	175	167	168	169	170	171	174	174
	160	187	183	178	175	175	176	177	181	181
5 ft 2 in	100	149	141	135	134	133	135	135	135	134
	110	163	152	144	143	145	145	147	147	147
	120	169	162	151	153	155	155	155	156	156
	125	171	163	158	157	156	158	160	161	161
	135	177	170	165	163	163	165	167	167	167
	140	180	173	168	166	166	168	170	171	172
	150	187	179	172	172	173	175	176	178	178
	160	192	187	181	179	178	180	181	185	185
5 ft, 3 in	100	153	146	141	140	139	141	141	141	140
	110	166	157	150	149	150	151	153	153	153
	120	173	166	157	158	160	160	161	162	162

* Based on Medico Actuarial Reports, 1912–1918 Table compiled by Louis I Dublin, Ph D of the Metropolitan Life Insurance Company

TABLE 3—*Continued*

HEIGHTS	MORTALITY RATIOS	WEIGHTS ACCORDING TO AGE PERIOD								
		20–24	25–29	30–34	35–39	40–44	45–49	50–53	54–56	57–59
5 ft, 6 in	150	206	200	197	196	196	197	200	202	203
	160	212	206	203	202	200	203	206	209	210
5 ft, 7 in	100	168	164	164	164	165	166	167	168	168
	110	179	175	173	173	174	176	177	178	179
	120	189	183	181	181	182	184	186	187	188
	125	192	188	186	185	185	187	189	191	192
	135	199	195	193	192	191	194	196	198	199
	140	203	198	196	195	194	197	199	201	202
	150	209	205	203	201	201	203	206	208	209
	160	215	211	208	207	206	209	212	215	216
5 ft, 8 in	100	170	167	168	169	170	172	173	175	175
	110	181	178	178	179	179	182	183	184	185
	120	191	187	186	187	188	190	192	193	194
	125	195	192	191	190	191	193	196	197	198
	135	203	199	198	198	198	200	203	204	205
	140	207	202	201	201	201	203	206	207	208
	150	212	209	208	207	207	209	212	214	215
	160	218	215	213	213	212	215	218	221	223
5 ft, 9 in	100	173	171	171	173	174	176	177	179	180
	110	182	180	181	184	184	186	188	189	191
	120	192	189	189	192	192	194	196	197	199
	125	196	194	193	194	195	198	200	202	203
	135	205	202	202	202	203	205	208	209	210
	140	209	206	205	205	206	208	211	212	214
	150	214	212	211	211	211	215	217	219	221
	160	221	218	217	217	217	220	223	226	228

TABLE 3—Continued

HEIGHTS	MORTALITY RATE %	WEIGHTS ACCORDING TO AGE PERIOD								
		20-24	25-29	30-34	35-39	40-44	45-49	50-53	54-56	57-59
5 ft. 10 in.	100	[illegible]	175	175	176	[illegible]	180	181	183	184
	110	181	181	184	[illegible]	188	190	192	193	195
	120	192	191	192	195	196	[illegible]	199	201	203
	125	[illegible]	195	196	195	199	[illegible]	204	206	208
	135	[illegible]	201	204	206	[illegible]	209	213	214	215
	140	210	208	208	209	210	212	216	[illegible]	219
	150	216	215	214	214	215	219	222	224	226
	160	223	221	221	221	221	225	228	231	233
5 ft. 11 in.	100	†	†	†	†	179	183	185	[illegible]	189
	110	180	182	186	189	192	194	196	197	199
	120	193	193	194	195	197	201	204	206	208
	125	198	[illegible]	199	201	204	206	208	211	213
	135	207	208	[illegible]	209	210	213	216	219	220
	140	211	209	210	212	213	217	220	222	224
	150	218	217	216	217	219	223	227	229	232
	160	225	224	224	224	225	230	233	236	238
6 ft. 0 in.	100	†	†	†	†	181	186	189	190	192
	110	179	183	188	191	195	197	200	201	203
	120	193	195	196	201	203	205	208	211	213
	125	*199*	*199*	*201*	*204*	*207*	*210*	*213*	*216*	*218*
	135	208	207	208	212	214	217	219	223	225
	140	213	211	212	215	216	221	223	226	229
	150	220	219	219	221	223	227	231	233	236
	160	227	227	[illegible]	228	229	234	238	241	243
6 ft. 1 in.	100	†	†	†	†	184	190	193	194	196
	110	180	185	191	194	198	202	204	205	208

† At these heights and ages all weights are over 100% mortality

TABLE 3—*Concluded*

HEIGHTS	MORTALITY RATIOS	WEIGHTS ACCORDING TO AGE PERIOD								
		20–24	25–29	30–34	35–39	40–44	45–49	50–53	54–56	57–59
6 ft 1 in	120	195	199	200	204	207	210	213	217	219
	125	201	201	204	207	211	215	218	222	224
	135	209	208	209	212	217	222	223	228	231
	140	216	213	215	218	221	226	228	232	235
	150	223	222	222	224	226	231	235	238	241
	160	229	230	230	231	232	238	243	246	249
6 ft 2 in and over	100	†	†	†	†	188	193	199	200	202
	110	180	187	193	197	101	205	208	210	212
	120	196	200	202	209	213	215	219	222	225
	125	202	204	207	211	216	219	223	227	229
	135	210	211	212	216	221	227	228	232	236
	140	218	216	217	221	225	230	232	235	240
	150	225	225	225	228	230	236	239	244	246
	160	231	233	233	236	237	244	248	252	254

Additions to Mortality Ratios for Overweights With Excess Abdominal Girths

ABDOMINAL GIRTH	RATIOS 100 TO 140 PER CENT INCLUDED			RATIOS 150 AND 160 PER CENT		
	Under age 40	Age 40–50	Age 50 and over	Under age 40	Age 40–50	Age 50 and over
1 inch excess	0	0	5	0	5	10
2 inch excess	0	5	10	5	10	15
3 inch excess	5	10	15	10	20	25
4 inch excess	10	15	25	20	30	40

cient reasons already set forth, but they have certain limitations. They will not construct bones, for these requisite parts of the body are characterized by their high content of the two chemical elements calcium and phosphorus, chiefly in the form of phosphate of calcium. Foods must, therefore, be rich in calcium and phosphorus, especially during the period of growth when the bony structure is forming. The disease of infants known as rickets is due to a deficiency in the lime salts for the growing bone, thereby leaving it soft.

From a study of many American dietaries Professor Sherman has shown that calcium is the element most likely to be lacking. He recommends that children of all ages from 3 to 13 years inclusive should have not less than 1 gram of calcium daily and he states that this can best be procured from a diet containing a full quart of milk a day together with other foods suitable to the age of the child. "Such a dietary," says Professor Sherman, "will practically always contain 1.0 gram or more of calcium and a proportionately liberal amount of phosphorus, as well as an excellent protein and vitamin content."[2]

Although milk is the best source of calcium for children and adults, vegetables such as celery, cauli-

[2] Sherman, H. C. Chemistry of Food and Nutrition, p. 316.

A SICILIAN MILK SUPPLY

In the ordinary Sicilian town goats are nearly as ubiquitous as human beings. Goats are Sicily's milk supply, and goatherds drive their flocks through the streets milking the animals into bottles before each housewife's door. Sometimes a protesting goat is forced to scramble up three or four flights of stairs to be milked in the presence of an indolent housewife unwilling to come to the street. (From "Sicily's Vanishing Medieval Peasantry," by Margaret I. La[illegible] in *Travel* for December 19[illegible]8.)

Spinach is the best common vegetable source of iron. Lettuce and cabbage are also excellent, and among the fruits, raisins and prunes stand out in their iron content. Graham bread is about as good a source of iron as lean beef and potatoes, and even the peanuts are not to be despised in this connection. If the diet comprises plenty of green vegetables, milk, and egg there will never be a lack of iron and an occasional meal with liver can be included for good measure.

Although there are a number of other minerals which are called for in the diet, only one needs special mention, and that is iodine. This mineral is necessary for the functioning of the thyroid gland, and lack of it gives rise to the disease known as goiter. In some parts of the United States, particularly in the Middle West, where goiter is prevalent, steps to prevent and control it consist of treating drinking water with iodine or distributing iodized salt for general consumption. The treatment of goiter is, however, usually a matter needing individual medical attention.

Sea foods are invariably rich in iodine. Oysters are among the leaders in this respect, while cod, halibut, haddock and salmon are rich in this necessary substance. Milk, leafy vegetables, and fruit usually contain more iodine than other foods, though the place where they are obtained is a factor affect-

ing the iodine content Thus, the cows in eastern Massachusetts will usually give milk with a higher iodine content than will those of central Michigan, the reason being the distance from the sea and the different iodine content of the feed and drinking water Similarly, canned milk produced in the east is likely to be a better source of iodine that fluid milk in the goiter belt in the Middle West although most milk has a definite value in preventing this disease

THE INDISPENSABLE VITAMINS

Given a diet adequate in energy, well supplied with proteins and other nutrients and efficient in its mineral content, proper nourishment could still not be achieved if one additional factor were not present Lack of the vitamins or of any one of them, would produce malnutrition Such a contingency, while possible, would not be probable, however, for in constructing the diet well balanced from the standpoint of its other essentials, vitamins are fairly certain to be present

Our information concerning the vitamins is comparatively recent for this part of the "newer knowledge of nutrition" has been developed entirely within the past twenty years or so The reader may ask what we did before the vitamins were discovered and he may pertinently inquire if we were not as

well fed then as now? The answer is that in general we were not If a few of us were, it was largely by accident, though instinct, as manifested by appetite and taste, unquestionably plays a part in helping us unconsciously to select foods which are good for us

That there was unexplained malnutrition before the advent of our knowledge of the vitamins is shown by the many epidemics of scurvy in the past This is a disease definitely proven to be due to a lack of vitamin C in the diet Who has not heard of pellagra, which from time to time, in fact most of the time, has been rampant in certain southern states? This disease has been clearly demonstrated to be a dietary deficiency one, due either wholly or largely to lack of one part of vitamin B, a fraction which has been denominated vitamin P-P by some workers because of its pellagra preventing properties Then there have been occasional outbreaks of an eye disease, as well as many isolated cases, because of failure to include vitamin A in the diet Finally, beri beri, often epidemic, or endemic in various parts of the world, may be mentioned as due to absence of the other fraction of vitamin B

The discovery of the vitamins came about from observations on this disease beri beri A Dutch physician in Java, Dr C Eijkman, was conducting nutritional experiments with fowls in 1897 and

noticed that a disease of these birds known as polyneuritis resembled beri beri in man. By accident he found that polished rice caused the disease, while brown or unpolished rice prevented it in the fowls, proving that rice polishings contain a necessary food factor. This discovery was confirmed by feeding experiments on many thousands of human subjects, chiefly convicts in Javanese prisons.

A dozen or more years later, Dr. Casimir Funk thought he had isolated a chemical substance which had this anti neuritic property and he gave to it the name of "vitamine," chosing this appellation because the substance was vital or life giving and because it resembled the chemical substance called an *amine*. Some years later after the third vitamin had been found, the "e" was dropped from the name and it now goes into the dictionary as vitamin, an accessory food substance necessary to proper nutrition.

Other early investigators contributed to the conception that there were accessory food factors in addition to the fats, proteins, carbohydrates, and minerals, whose functions were already more or less understood. In England in 1906 Dr. F. G. Hopkins tried feeding laboratory animals on purified substances which were dietetically correct according to existing knowledge, but his animals died. When a small quantity of milk was added they survived and

prospered, and so Hopkins concluded that milk contained something which was essential to good nutrition, though he did not publish his evidence in full until 1912

A few years later two sets of American investigators, McCollum and Davis, and Osborne and Mendel, announced almost simultaneously the discovery of a substance in foods which came to be known as "fat soluble A" and later as vitamin A These workers also independently helped to clarify the knowledge regarding a water soluble factor, which later entered the lists as vitamin B Vitamin C was added in 1920, and D and E have since joined this alphabetical category

Today six vitamins are definitely known and others are indicated by research which is in progress Since the classic studies of Eijkman, Funk, Hopkins, McCollum, and Osborne and Mendel, great progress has been made in our knowledge of the vitamins and even more brilliant discoveries are likely in the future A brief description of the functions and sources of each of the vitamins recognized today will be of value in aiding in the attainment of the well balanced and adequate diet

Vitamin A

Vitamin A is in many ways the most significant of the known vitamins, for it is an essential factor

TABLE 6

Vitamins in Foods*

+ = contains the vitamin
++ = good source of the vitamin
+++ = excellent source of the vitamin
— = no appreciable amount of the vitamin
? = doubt as to presence or relative amount
* = evidence lacking or insufficient
V = variable

Food	Vitamin			
	A	B	C	D
Bread (water)	?	+	—	—
Bread (milk)	+	+	—	+
Bread, whole wheat (water)	+	++	?	—
Bread, whole wheat (milk)	++	++	?	+
Barley (whole)	+	++	—	
Corn, yellow	++	++	—	
Oats	+	++	—	—
Rye cracked	+	++	?	
Wheat whole	+	++	—	?
Wheat, bran	+	++	—	
Liver	++	++	+	+
Kidney	++	++	+	+
Brains	+	++	?	+
Heart	+	++	+	+
Fish fat	+	+	?	—
Fish roe	++	++	?	+
Cod liver oil	+++	—	—	++
Milk, fresh (unpasteurized)	+++	++	+V	++V
Milk, condensed	+++	++	+V	+V

* Bureau of Investigation of the American Medical Association 1928

TABLE 6—Continued

FOOD	VITAMIN			
	A	B	C	D
Milk evaporated	+++	++	?	
Milk dried (whole)	+++	++	+\	
Milk skimmed	+	++	+\	
Buttermilk	+	++	+\	
Cream	+++	++	+\	
Butter	+++	—	—	+V
Cheese (whole milk)	++	?	•	
Eggs	+++	+	—	+
Almonds	+	++	•	
Coconut	+	++	•	+
Hickory nuts	•	++	•	
Peanuts	+	++	•	
Walnuts	+	++	•	
Tomato (raw or canned)	++	++	+++	
Beans kidney	+	+++	•	
Beans navy	+	+++	•	
Beans string	++	++	++	
Beets (roots)	+	+	+	
Beets (greens)	++	++	•	
Cabbage raw	++	++	+++	
Cabbage canned	+	++	+	
Cabbage cooked briefly	+	++	+	
Carrot	+++	++	++	
Cauliflower	+	++	+	
Dandelion greens	++	++	+	+
Watercress	+++		+++	+V
Lettuce (garden)	++	++	+++	+
Onions	+	+	++	
Parsnip		++	?	
Peas fresh		++	+++	+
Potato (boiled)	+	++	+	
			—	

Milk and the green vegetables do possess this vitamin but are relatively low in it, and, no other foods are important sources so far as is known

Vitamin E

Vitamin E has some influence in the prevention of sterility, but is less important in this regard than is vitamin A Since vitamin E occurs quite widely in nature it is not thought to be of great practical significance It is found in seeds, green leafy vegetables, flesh meat, and in milk and butter

Since the discovery of the vitamins and the development of our knowledge concerning them, many patent vitamin foods have appeared, but as has been well pointed out by Professor McCollum and others, the place to get the indispensable vitamins is from the garden, the milk man, the market, and the grocery store and not from the drug store, except, of course, in the case of cod liver oil, which furnishes vitamin D and is also potent in vitamin A

WATER

Water is one of the necessaries of life, for it is a constituent of body tissues and even of the bones This combination of hydrogen and oxygen, H_2O, is not chemically altered in the body, but does much valuable work It promotes digestion, helps elimi

nate waste, influences bodily temperature, and contributes to general metabolism

Authorities on personal hygiene usually recommend at least six glasses of water a day for the average individual Fluids are of course, obtainable from other sources Milk, for instance, contains about 87 per cent water and so is valuable for its fluid as well as its solid content

FOOD SELECTION

From this brief review of the field of nutrition it will be seen that right food selection while important, is not a tremendously complicated matter The requirements of special classes of persons, such as pregnant and nursing mothers infants and school children are discussed briefly in another part of this book [3]

The housewife who desires to make a wise selection of foods so that they will be economical as well as nutritious is advised by Prof Mary S Rose to employ the following plan [4]

		per cent
I	Foods from the cereal grains (including bread crackers macaroni rice etc as well as breakfast foods)	30

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[3] See Chapter VI p 139

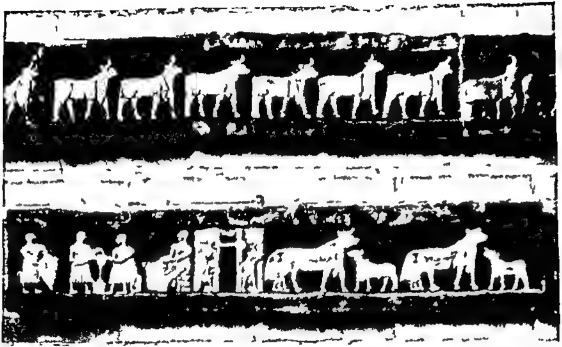
[4] Rose M S The Foundations of Nutrition p 379 Macmillan 1927

THE OLDEST USES OF MILK

Four thousand years before Christ there were cows at Ur and they were milked by methods similar to those in modern Mesopotamia The discovery of these ancient milking procedures is due to excavations made during recent years by the Joint Expedition of the British Museum and the Museum of the University of Pennsylvania These explorations, which were conducted at Tel El Obeid, or Al Ubiad, have been reported by Mr C Leonard Wooley and others in various issues of the *Museum Journal* The inscriptions found by these archeologists constitute the oldest known reference to milk, though there is evidence that the prehistoric lake dwellers of Lake Geneva were likewise users of milk

King A-an-ni pad da, of the first dynasty of Ur, built a temple on a mound four miles from his capital On the façade of this shrine he erected several continuous friezes and it is upon one of these that the famous milking scene is to be found On the lower frieze were a series of reliefs in copper showing bulls lying down with their faces turned toward the spectator Above this was a frieze cut from the limestone and conveying a unique view of pastoral life among the ancient Sumerians

In the center of this scene is a byre apparently made of reeds bound with rope, the door flanked



[illegible] ty of Pennsylvania

THE MILKING SCENE AT UR

Frieze found at Tell al Ubaid by the Joint Expedition of the British Museum and the Museum of the University of Pennsylvania to Mesopotamia The figures are of shell or white limestone and are inlaid in bitumen which originally covered wood when found the wood had completely decayed About 3000 B C

with spears and adorned above with a crescent, possibly representing the sacred horns of cattle From the door of this byre emerge two heifers, while on the right are two cows which are being milked by men sitting directly under the cows' tails Beside each cow is a calf, muzzled so as to prevent it from filching the milk On the left of the door are four men who are evidently straining and storing the milk or some product possibly butter, made from it One man has his hand in a huge jar, the next is pouring milk from a small jug into a large strainer held by his companion while the fourth man holds a massive jar between his knees

The Sumerians and the Babylonians of old worshipped the cow as a goddess She was known as the "Mother of the Moon" while the milk goat was called "Mother of the god Ningirsu" The Babylonians pictured the mother goddess with breasts so full that they must be supported A cuneiform text from the Babylonian gives a recipe for driving out the demon of sickness using these words, "Bring milk and laban (curdled milk)" and the hope is expressed, "may that man become as pure as laban, like that milk may he become pure "[1]

The ancient Egyptians often depicted the heavens as a cow with a full udder The cow was conse-

[1] Barton George A Encyclopedia of Religion and Ethics p 635

crated to Isis, goddess of agriculture, but more than that she was goddess in her own right and called Hathor, who guarded the fertility of the land and caused the Nile to overflow at regular intervals An Egyptian tomb drawing shows a young boy on his knees sucking milk from a cow, while a calf is busy at another of the maternal founts The cow apparently appreciated the attention, for the drawing portrays her as licking the boy's head [2]

The Aryans of Central Asia were undoubtedly the first herdsmen and, as Mr H G Wells has written, civilization began when the huntsmen turned herdsmen Among primitive Aryans a drink called haoma was considered sacred It was concocted by crushing twigs of a sacred plant and mixing the juice with milk and holy water [3] It produced a fine condition of inebriation In the Vedic songs of India, which are as old as the Old Testament, the cow was declared to be man's greatest benefactor and milk was viewed as a symbol of nourishment These ancient hymns tell how milk was drunk and butter consumed two thousand years or more before Christ, and they inform us that milk was valued so highly that it was considered to be the most valu-

[2] Manchester H H Six Thousand Years of Dairying *Dairyman s League News* February 1923

[3] Browne, Lewis This Believing World 1928

able offering to the gods Rigveda addresses Indra, god of the firmament, as follows

> "With honey of the bees is the milk mixed,
> Come quick run and drink"

The sea kings of Crete also were users of milk some two millennia before Christ, for at the Palace of Broad Knossos there have been uncovered "cups and vases with painted designs, and reliefs of cows and calves, wild goats and kids" This island was the refuge of Zeus, king of the gods, when his father, Saturn or Kronos, sought to slay him Rhea, the mother of Zeus, took her son to a cavern in Crete, where legend has it that he was nourished on honey and goat's milk Due to the strength gained from this fare, he later wreaked a terrible vengeance on his unnatural parent

MILK AND HONEY

In the civilization of the ancient Hebrews, more or less parallel with that of Crete, and only a little later than Egypt, milk was held in high favor Not once, but some twenty times, does the Old Testament mention a land which "floweth with milk and honey" (See, for example, EXODUS 3 8, JOSHUA 5 6, LEVITICUS 20 24) Joseph was a herdsman and his countrymen were regarded as experts with cattle The wisdom of King Solomon was never better displayed

than in his admonition to his followers, "Thou shalt have goats's milk for thy food, for the food of thy household, and for the maintenance for thy maidens" (PROVERBS 27 27) In all, there are some fifty references in the Bible to milk and milk products[4] Cypriote milk bowls with wish-bone handles, dating from the time of Thothmes III (1501–1447 B C) were discovered in 1927 at Beisan in Palestine by the University of Pennsyl vania's field expedition under Alan Rowe

"Milk and honey" was a favorite phrase in many ancient civilizations, Babylonian and Hindoo, as well as Hebrew It passed on to the Greeks and Romans, and Ovid (43 B C –A D 17) wrote,

> 'Now rivers of milk now rivers of nectar run,
> And yellow honey distils from the green ilex '

Shakespeare, who refers to milk many times in his works, uses the words, for in *Love's Labor Lost* (V, 2—231) we find, "One sweet word with thee—honey, and milk, and sugar " Coleridge in his poem *Kubla Khan* likewise employs the term when he writes, "For he on honey dew hath fed, and drunk the milk of Paradise "

Down the ages of all the early civilizations the cow and the bull were revered as sacred Brahminy

[4] A list of biblical references to milk is given at the end of this

was the precious bull of the Hindoos, while the Cretans had the mythical minotaur, and the Greeks worshipped Mnesis, the sacred ox There was the golden calf of the Israelites, and Taurus has found a place in the Zodiac At Mycenae in Greece one of the ancient dagger glades was ornamented with the scene of a herd of kine with upright horns On the Grecian urn, immortalized by Keats, was a view of a festival in honor of the cow These are the words of the poet

'To what green altar O mysterious priest,
Leadst thou that heifer lowing at the skies
And all her silken flanks in garlands drest?

GREECE AND ROME

The story goes that Romulus and Remus, the founders of Rome, were nursed by a she wolf When, however, Romulus laid out the eternal city, he traced a furrow around the Palatine Hill with a plough drawn by two milk white cattle When he had finished his labors, he poured out a libation of milk to propitiate the gods, particularly Jupiter, who was suckled by the goat Pliny, who wrote a book or two on milk in his Natural History, tells us that the same ceremony was carried out some eight centuries later

In the Sybilline Oracles, a collection of Greek prophecies brought to Rome in the time of Tar-

quinus Superbus, seventh and last king of Rome, it is said (III, 744), "He will cause sweet fountains *of white milk to burst forth*" When Homer smote his lyre, nine centuries before Christ, he mentioned milk at least on four occasions in the *Iliad*, where among other things he tells that the Achaeans resembled in numbers the swarms of flies gathered about milk vessels in the springtime, a good commentary on ancient sanitation In the *Odyssey* it was related that neither milk nor cheese failed in Libya the whole year through Homer called a Scythian tribe "mare milkers" and he compared the shouts of the Trojans to the bleating of sheep at milking time

Herodotus, the historian, and Hippocrates, the father of medicine, who lived about five centuries before Christ, both wrote of milk, and the latter recommended it highly as a beverage Their contemporary, Pindar, extolled milk in one of his writings, saying, "Rejoice, my friend! *Lo, I* send you, though at late hour, this honey mixed with white milk, fringed with the froth of blending, a draught of song conveyed in the breathings of Aeolian flutes" Could there be any more felicitous description of the most nearly perfect food?

The accounts of milk in ancient literature are in *fact* unusually copious Hesiod and Aristotle, Greek writers of the ninth and fourth centuries, B C

respectively, wrote much about milk Plutarch praised cheese most highly and said that Zoroaster, the Persian prophet of the seventh century B C, lived for twenty years exclusively on cheese The *Avesta* of Persia frequently mentions sacrificial gifts of boiled milk Strabo, a Greek geographer of the first century, B C, informs us that milk was the chief means of subsistence among the Ethiopians, and the Lusitanians, who lived in what is now Portugal A Roman writer of the third Century, B C, one Apicius, wrote a book on milk, dealing especially with its quality Virgil (70–19 B C) wrote that Queen Dido gave Aeneas and his companions a flock of cattle to nourish them The value of cattle in those days is shown by the fact that the Roman term *pecunia* for money is derived from *Pecus*, the word meaning cattle The Empress Poppaea, wife of Domitius Nero, considered milk of value when used externally as well as internally, and she had 500 asses supply her with milk for a daily beautifying bath

Josephus, the contemporary of Christ and Paul, told in one of his historical writings that "Abel brought milk and the first fruits of his flock as offerings" Even Caesar in his Commentaries has observations on peoples who lived by keeping cows, for most of the tribes of the north did that Galen (131–201 A D) asserted that the milk of Stabia,

a town of Campania, was particularly salutary because of the growth of certain peculiar vegetables in the neighborhood and this may well have been the case, for we know today that the feed of cattle has a definite effect on the quality of milk Galen, who was the medical leader of his time, also wrote that a man lived more than one hundred years on milk alone

MILK IN MEDIEVAL TIMES

In the early Christian Church, milk was often substituted for wine in the communion, but this practice was later prohibited by canon law St Bridget (453–523) was regarded as the special patron of milking At Bethlehem there is said still to be a cave known as the Milk Grotto, where, legend has it, the Holy Family took refuge There the Virgin nursed the Child and a drop of her milk fell on the floor Sojourn in this cave is consequently thought to increase the flow of milk and cure barrenness

The Cathedral at Rouen is said, in an engrossing book on the history of food written in 1843, to have a tower known as the "Butter Tower" In 1500 there was a scarcity of oil during Lent and the archbishop authorized the use of butter on condition that each diocese pay six deniers Tournois, about a farthing each, for this privilege The revenue from this source was sufficient to build the tower

When Marco Polo traveled about the world in the thirteenth century (A D) he discovered some interesting facts about milk Throughout Asia he found many cattle "well sized fat and exceedingly handsome," so he wrote, and he sampled the koumiss of the Tartars, a soured milk which contains some alcohol and is intoxicating "Marco Millions," as he was nicknamed, also related that his friend Kublai Khan, drank mare's milk and that the Khan kept a large number of white mares in order to have an adequate supply of this milk for the sole use of himself and family

Once a year the Mongols held a ceremony in which the milk of a white mare was sprinkled upon the ground as a libation so that "the Earth and the Air and the False Gods shall have their share of it " This milk ceremony was likewise described by a Chinese writer of the period, one Chang te hui, though he set a different date for the festival than did Mr Polo In 1826, several centuries later, another author (Baber) informs us that koumiss was sprinkled upon the war flags of the Mongols before going into battle

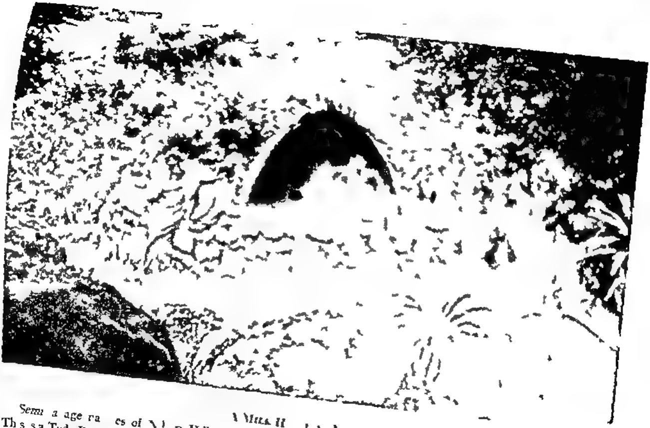
Marco Polo described the first known dried milk, that of the Mongols, in the following interesting words [5]

[5] Yule Sir Henry The Book of Ser Marco Polo The Venetian p 254 1875

"They also have milk dried into a kind of paste to carry with them, and when they need food they put it in water, and beat it up till it dissolves, and then drink it It is prepared in this way, they boil the milk, and when the rich part floats on the top they skim it into another vessel and of that they make butter, for the milk will not become solid till this is removed Then they put the milk in the sun to dry And when they go on an expedition every man takes some ten pounds of this dried milk with him, and of a morning he will take half a pound of it and put it in his leather bottle with as much water as he pleases So, as he rides along, the milk paste and the water get well churned together into a kind of pap [emulsion] and that makes his dinner"

Rubruquis, a French traveller, writing in 1839, tells of an almost exactly similar process employed by the Mongols of that time for the manufacture of a preparation called "Kurut"

During the Middle Ages dairying was developed to a considerable extent but it was not until the eighteenth century that the breeding of cattle and the production of milk began to take on the aspects of a science In 1350 an English housebook contained a picture of a cheese store and also a woman making butter In the fifteenth century Louis XI (1423–1483) is said to have attempted to cure himself of a cutaneous affection by eating cheese, drinking fresh milk, and taking potions composed chiefly of loupin peas One of his successors, Francis I, the French monarch who met Henry VIII of England on the Field of the Cloth of Gold, became ill on one occasion and the royal physicians



Semi a age ra es of N l n H ll on the Ind an Penin ula ... Mita H ... N ...
Th s s a Toda Da ry Hut

failing to cure or relieve him, was advised to send for a certain Jewish doctor of Constantinople This gentleman prescribed asses' milk as the regal remedy and the king happened to recover From that time on he consumed asses' milk for any and every ailment with which he was afflicted The people of Rome were said by Pliny to have rubbed bread soaked in asses' milk on their faces to make them fairer and prevent the beard from growing

SHAKESPEARE ON MILK

Among the many plays of the myriad minded Shakespeare there is one in which the heroine is a "queen of curds and cream" She is the fair Perdita of *The Winter's Tale* whom Florizel, like "The fire robed god, Golden Apollo," wooed and won in a cottage of Bohemia But Florizel was a king's son and the king, while acknowledging Perdita to be "the prettiest low born lass that ever ran on the green sward," did not favor low born lasses for his son Finding the lovers together he upbraids Florizel and orders the prince to "follow us to court"

The dream is evidently over for Perdita, who says, (IV, 3—461) "Being now awake, I'll queen it no inch further, but milk my ewes and weep" It seems, however, that Perdita is a shepherdess by accident only and that really she is the daughter of

the king of Sicily As is usual in such cases the match is ultimately sanctioned, and Perdita, having had a rich experience as a dairymaid, undoubtedly makes Florizel an excellent spouse

Though his heroine in *The Winter's Tale* was gracious as a milkmaid, the Bard of Avon apparently thought none too well of persons in this ancient profession, for Cleopatra while lamenting over Antony's body, just after his famous words, "I am dying, Egypt, dying," speaks as follows *(Antony and Cleopatra*, IV, 15—74) "No more, but e'en a woman, and commanded by such poor passion as the maid that milks and does the meanest chores "

In Shakespeare's time during the sixteenth century, a milkmaid was indeed one who did the meanest kinds of work and yet these wenches did not always lack romance In *Measure for Measure* (I, 3—77) Lucio, the Fantastic, tells Claudio, the young gentleman, "Thy head stands so tickle on thy shoulders that a milkmaid, if she be in love, may sigh it off " Then again Launcelot, the clown in *Two Gentlemen of Verona*, in a soliloquy about love and the inestimable object of his affection reveals (III, 1—268) that "'tis a milkmaid" and in discussing the "cat log" of her conditions, he says (III, 1—277), "*She can milk*, look you, a sweet virtue in a maid with clean hands," a phrase in which Shakespeare, perhaps consciously, exhibits a

real conception of dairy sanitation A few lines further the clown agrees with Speed when he declares the girl's first quality to be that "she can milk," to which Launcelot quoth then, "Ay, that she can"

In the thirty seven plays of the immortal poet there are about seventy five references to milk, butter and cheese, though of course, many of these are only figures of speech, some of them metaphors, some similes, and some hyperboles Consider the caustic statement from *Coriolanus* (V, 4—30), "there is no more mercy in him than there is milk in a male tiger" Or this from *Macbeth* (I, 5—49), "Take my milk for gall" In *1 Henry VI* (V, 4—27) there is a choice curse employing milk, but on the other hand the celebrated "milk of human kindness" is mentioned in *Macbeth*, (I, 5—18), and in *Romeo and Juliet* (III, 3—55) we are told of "adversity's sweet milk, philosophy"

After King Lear has bestowed a third of his kingdom on each of his married daughters, Goneril and Regan, he turned to this third unmarried daughter, Cordelia, saying, (*Lear*, I, 1—86) "Now, our joy, although the last, not least, to whose young love the vines of France and milk of Burgundy strive to be interess'd, what can you say to draw a third more opulent than your sisters?" But Cordelia asked only love and not vines or milk

Another reference, a somewhat jocular one, from *King Lear* likewise deserves mention The Fool entertains the King by telling him (*Lear*, II, 4—127) that "'Twas her brother that, in pure kindness to his horse, buttered his hay " And in the *Merry Wives of Windsor* (III, 5—8) Falstaff remarks "I'll have my brains ta'en out and butter'd, and give them to a dog for a new year's gift "

The *Taming of the Shrew* contains an interesting phrase which on first glance seems to concern a famous golden dairy product "Take them to the buttery," commands the genial host, "Let them want nothing that my house affords " The players so favored were not, however, further regaled with buttermilk, but with wine, for a buttery is a place of butts, or casks, containing not the lacteal secretion of the cow, but the juice of the grape

Butter does receive plenty of mention in some of Shakespeare's other plays Thus, in *1 Henry IV*, someone seems frequently to be calling for eggs and butter (see I, 2—23, II, 1—65, and II, 4—135) and at one place (IV, 2—67) that "soused gurnet" the rotund Falstaff, characterizes himself to Prince Henry as "vigilant as a cat to steal cream," to which the prince's repartee is "I think to steal cream indeed, for thy theft hath already made thee butter " A great punster, that fellow Shakespeare In another part of the same play (II, 3—36) Hot

spur speaks glibly about "moving such a dish of skimmed milk with so honourable an action" In *2 Henry IV* (III, 2—332) Falstaff describes Shallow as "like a man made after supper of a cheeseparing"

"I will rather trust a Fleming with my butter," Ford informs the other Falstaff in the *Merry Wives of Windsor* (II, 2—318) "than Parson Hugh the Welshman with my cheese, an Irishman with my aqua vitae bottle, or a thief to walk my ambling gelding, than my wife with herself" Cheese figures in a number of the passages of Shakespeare, though too often as a term of derision Bardolph, one of Falstaff's followers, calls Slender (I, 1—130) a "Banbury cheese", but Lear, "Every inch a king" though quite mad, thinks he sees a mouse and says (IV, 6—20), "This piece of toasted cheese will do it" Again in the *Merry Wives of Windsor* (I, 2—13) one of the characters declares, "I will make an end of my dinner, there's pippins and cheese to come"

The famous Biblical combination of milk and honey, mentioned a score of times in the Book of Books, is plagiarized apparently but once by the great bard "One sweet word of thee," he says in *Love's Labour Lost* (V, 2—231) "honey, and milk, and sugar" At the very end of this play comes a song in which winter is described among other things, as the time (V, 2—925) "When milk comes

frozen home in the pail " A fairy asks Puck in *A Midsummer Night's Dream* (II, 1—26) if he be not the one "that frights the maidens of the vil lagery, skim milk, and sometimes labour in the quern, and bootless makes the breathless housewife churn, and some times makes the drink to bear no barm?"

In a dialogue between Hamlet and the Ghost, that ethereal character is calmly outlining a poison ing and its effects as it courses through the body "And with a sudden vigor it doth posset and curd," he says (I, 5—69) "like eager droppings into milk " Such a description might well turns "livers white as milk" such as Bassanio in the *Merchant of Venice* (III, 2—86) claims a coward to have A "milk liver'd man" is also mentioned in *Lear* (IV, 2—50) A word Shakespeare employed for a "paltry fellow ' was "milksop," using this term twice, in *Richard III* (V, 3—325) and in *Much Ado About Nothing* (V, 1—91) where he blends "Boys, apes, braggarts, jacks, milksops "

"Milk-white" is a term occurring eight times in the plays of Shakespeare There are "hands as pale as milk" in the *Midsummer Night's Dream* (V, 1—345) and "innocent milk" in the *Winter's Tale* (III, 2—101) All in all, Shakespeare does not speak copiously of the most nearly perfect of human foods, a nutriment which in his day was not recog-

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The following poem about milk is printed in a quaint book published in 1840 The author is Lowell Mason and the title of the book is *Little Songs for Little Singers* The number of poems about milk are unfortunately few and while this one may not rank with the productions of the great poets, it is, nevertheless, of interest

MILK SONG

Father it is thy kindness
Gives us milk to drink
Milk how pleasant tastes it
Very good we think.
In the cup or basin,
It is white as snow
Sweet as the flowers
In the fields grow
Milk the red cheek freshens
Makes the mind serene
Beautifies the sunshine
Brightens all the green
Yes it is thy kindness

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Gives the milky treasure,
Children s sweetest food
Father, may we never
Be denied this food,
Nor seek after other
While this is so good

MILCH CATTLE

From the lands around the English Channel have come most of the modern breeds of cattle Who does not recognize the designation Jersey and Guernsey, and their origin? To the British, the Dutch and the French must go the credit for the development of the cattle of today, though the Swiss have also made some important contributions All of these cattle are descendants of the hairy Urus of Asia, Europe, and Northern Africa, which Caesar described as approaching the elephant in size, and of the smaller but even more widely distributed Celtic Shorthorn[6]

The Americas never had any native cattle of their own, though the bison is a distant relative of the cow Coronado on his long tramp, about 1540, in quest of the Seven Cities of Cibola first discovered the bison, which he called a cow, saying that these "cows" were as numerous as the fishes

[6] Sanders A H The Taurine World *National Geographic Magazine*, December, 1925

in the sea Real cows had however been shipped to Mexico as early as 1521 for cattle had been brought to the West Indies from Spain immediately after the voyage of Columbus Some of these Spanish Longhorns were sent from Santo Domingo to North America and from there were taken north of the Rio Grande during various expeditions In later years the Longhorns of Texas were crossed with other breeds to produce staunch stock In 1927 the United States government made an appropriation to secure and perpetuate a herd of Texas Longhorns for historical purposes

The colonists at Jamestown imported cattle from England and Spain as early as 1611 and the Dutch settlers on Manhattan brought 103 head of Friesian cattle with them in 1625 The Pilgrims had no cows when they landed at Plymouth in 1620 and their sufferings during the first year or two on the bleak New England shore were due in no small degree to nutritional troubles The Pilgrim Fathers sent to Holland for 30 head of cattle, which arrived at the end of their first year, and more came in 1630 and 1633 By 1650 the New England colonies had ceased to import butter and cheese from the mother country and instead were exporting these commodities and also cows

Two hundred years later there were more than six million dairy cattle in this country About that

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time Mr Robert M Hartley wrote an interesting book with one of those lengthy titles which were in vogue in those days, "Historical, Scientific and Practical Essay on Milk as an Article of Human Sustenance, with a *consideration of the effects consequent upon the present* Unnatural Methods of *producing it for the supply of large cities*" In this book the author begins by declaring that milk is "*a model of what a nutritious substance* ought to be, and the most perfect of all elementary aliments," and he pointed out that Brooklyn and New York City were consuming five million gallons of milk annually

That was in 1842 In 1785 a physician named Samuel Ferris had published a work entitled "A Dissertation on Milk" with twelve lines of subtitle, in which he wrote in the introduction, "Milk is of very extensive use as an article of diet, and its advantages are peculiar, because, with but few exceptions, it is, under some shape or other, alike proper for the valetudinarian and convalescent, as for one of unimpaired health" A century later in 1875, there appeared an English book called "Milk in Health and Disease," by A Hutchinson Smee, M R C S, which also extolled milk, but pointed out, perhaps for the first time, that "milk can be a vehicle of contagion," though the reasons put forward were not entirely correct Dr Smee thought milk ab-

sorbed contagion by exposure to deleterious gases, altered secretion of diseased animals, and from the water used for adulteration "Milk is universally contended to be the most perfect single article of food to be found in the whole realm of nature—the only natural product perfectly fitted to sustain life," wrote S L Goodale, Secretary Maine Board of Agriculture, in 1872

Today the United States, with about twenty five million dairy cows, leads the world in milk production In New York City (which now includes Brooklyn) about three million quarts of milk are consumed daily, almost as much as was sold annually a century ago The nation as a whole uses almost half a quart a day per person, according to the figures of the United States Department of Agriculture This is about one half what it ought to be, for physicians and scientists are now agreed that a quart of milk a day in some form is the amount which should be in the diet of every child and that this quantity is none too much for normal adults

Throughout the course of history, milk has been hailed as the ideal food, an opinion which is well justified by our modern knowledge of the science of nutrition The races which have always subsisted on liberal milk diets are the ones who have made history and who have contributed the most to the

advancement of civilization As was well said by Herbert Hoover in an address on the milk industry, delivered before the World's Dairy Congress in 1923 "Upon this industry, more than any other of the food industries, depends not alone the problem of public health, but there depends upon it the very growth and virility of the white races"

BIBLICAL REFERENCES TO MILK AND ITS PRODUCTS

GENESIS 18 8 And he took butter and milk, and the calf which he *had dressed, and set it before them, and he stood by them under* the tree, and they did eat

GENESIS 32 15 Thirty milch camels

GENESIS 49 12 His eyes shall be red with wine, and his teeth white with milk.

EXODUS 3 8 Milk and honey

EXODUS 23 19 34 26 Shalt not seethe a kid in his mother s milk

LEVITICUS 20 24 Floweth with milk and honey

NUMBERS 13 27, 14 8 16 13 14 Milk and honey

DEUTERONOMY 6 3, 11 9 26 9, 15 27 3 Milk and honey

DEUTERONOMY 14 21 See EXOD 23 19

DEUTERONOMY 32 13–14 He made him ride on the high places of the earth that he might eat the increase of the fields and he made him suck honey out of the rock, and oil out of the flinty rock Butter of kine and milk of sheep with fat of lambs and rams of the breed of Bashan, and goats with the fat of kidneys of wheat and thou didst drink the pure blood of the grape

JOSHUA 5 6 Milk and honey

JUDGES 4 19 Give me I pray thee a little water to drink for I am thirsty And she opened a bottle of milk and gave him drink

JUDGES 5 25 He asked water, and she gave him milk, she brought forth butter in a lordly dish.

1 SAMUEL 17 18 And carry these ten cheeses to the captains of their thousands and look how thy brethren fare

2 SAMUEL 17 29 And honey and butter and sheep and cheese of kine for David and for the people that were with him to eat for they said the people is hungry and weary and thirsty in the wilderness.

JOB 10 10 Hast thou not poured me out as milk and curdled me like cheese?

JOB 20 17 He shall not see the rivers the floods the brooks of honey and butter

JOB 21 24 His breasts are full of milk and his bones are moistened with marrow

JOB 29 6 I washed my steps with butter

PSALMS 55 21 The words of his mouth were smoother than butter but war was in his heart his words were softer than oil yet were they drawn swords

PROVERBS 27 27 And thou shalt have goat s milk enough for thy food for the food of thy household and for the maintenance of thy maidens.

PROVERBS 30 33 Surely the churning of milk bringeth forth butter

SONG OF SOLOMON 4 11 Honey and milk are under thy tongue

SONG OF SOLOMON 5 1 I have gathered my myrrh with my spice I have eaten my honey-comb with my honey I have drunk my wine with my milk

SONG OF SOLOMON 5 12 His eyes are as the eyes of doves by the rivers of waters washed with milk and fitly set

ISAIAH 7 15 Butter and honey shall he eat that he may know to refuse the evil and choose the good

ISAIAH 7 22 And it shall come to pass for the abundance of milk that they shall give he shall eat butter for butter and honey shall every one eat that is left in the land

ISAIAH 28 9 Whom shall he teach knowledge? and whom shall he make to understand doctrine? Them that are weaned from the milk and drawn from the breast.

ISAIAH 55 1 Ho everyone that thirsteth come ye to the waters and he that hath no money come ye buy and eat yea come buy wine and milk without money and without price

order to get milk of fairly uniform consistency, commercial milk companies generally mix the milk from large herds, often containing several breeds The minimum fat content of milk to be sold for human consumption is usually set by law at 3 25 per cent

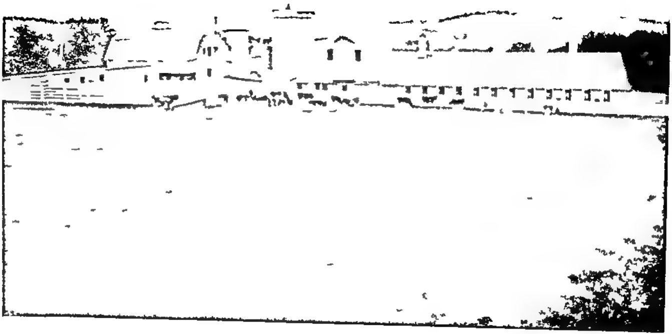
A good definition of milk is that included in the standards for milk products issued by the United States Department of Agriculture, which reads as follows

"Milk is the whole fresh, clean, lacteal secretion obtained by the complete milking of one or more healthy cows, properly fed and kept excluding that obtained within fifteen days before and five days after calving or such longer periods as may be necessary to render the milk practically colostrum free"

COLOSTRUM

For some time after the birth of offspring, the mammary gland of the mother secretes a substance known as colostrum At first the secretion is wholly colostrum, but this gradually diminishes and is eventually replaced entirely by normal, or so called mature milk In humans this process requires about a month, at the end of which time breast milk is practically colostrum free In cows the period is shorter, averaging about a week

Colostrum is of much importance to the well being of the offspring Although babies who must be



A Farm Where Certified Milk Is Produced

artificially fed from birth can thrive without it, human colostrum seems to have certain favorable biological properties. It tends to produce an immunity to disease in the new born infant and it gives the baby an auspicious start in life. This is one of the many reasons why breast milk is of such great value in infant feeding. It may be necessary, however, to supplement breast feeding during the first few days of life, and it may also be desirable to do so later. Formulas made from sweetened condensed milk have been found of especial value at this time.[1]

Calves are benefited by colostrum from their own mothers, but the consensus of opinion seems to be that babies and other persons should not imbibe the colostrum of cows, even though human colostrum is good for babies. As a consequence the sale of milk from cows immediately after parturition (calving) is generally prohibited by law.

THE COMPONENTS OF MILK

Every component of milk has a distinct value in human nutrition as has already been stated. The sum of the components is, naturally, also of great value. That this is so is shown by the fact that during infancy pure milk serves as a complete food, adequate to maintain the child in good health. In later child-

[1] McLean [illegible] and Fales H L Scientific Nutrition in Infancy and Early Childhood, p 83 Lea and Febiger, 1925

hood and adult life it is nearly a complete food and by itself can sustain life for a considerable, though limited, period

During the first year of life, the diet is made up almost exclusively of milk, though if cow's milk is used it must be "modified" to resemble human milk more closely than it does in the natural state Nowadays it is also customary to supplement the infant diet, using cod liver oil from the first month of life or so, orange juice or tomato juice from the second month, and small but gradually increasing amounts of solid food from about the sixth month

This procedure lends variety to the diet, prepares the child for its future nutritional regimen, and incidentally makes up for the few slight deficiencies of milk Thus, cod liver oil is a bottled substitute for sunshine, supplying the vitamin which helps to utilize the minerals in milk in the building of bones and teeth, and thus preventing rickets Orange and tomato juice furnish the vitamin which averts scurvy, a vitamin which may be partially destroyed in milk when it is heated in the presence of air Solid foods give additional calories and also may yield iron, in which milk is somewhat low, though what there is of it is in a particularly valuable form In spite of these few minor defects, milk honestly deserves the appellation as the most nearly perfect food, and this fact will be readily apparent when we consider the virtues of

its constituent parts the fats, proteins, carbohydrates, minerals, vitamins, and fluids

First let us examine the fats In a bottle of milk we notice that cream has collected at the top and that there is a well defined cream line This cream is the fat of milk, rising to the top because it is made up of oily substances lighter than water The amount of fat in milk varies roughly from 3 to 6 per cent, with a general average of 3 7 per cent, though the quantity depends, as previously explained, on the breed of cattle and other factors

THE VALUE OF MILK FAT

Milk fat is comprised of globules of microscopic size There are millions of them in a teaspoonful of milk, and it is interesting to note that these globules were first observed in 1674 by Van Leeuwenhoeck, the scientist who did the early work on the microscope, and who was one of the first to see bacteria The clumping of these fat globules is promoted by the rapid cooling of milk immediately after milking

Cream is sometimes displayed to better advantage in raw than in pasteurized milks All the fat of the milk is, however, present in pasteurized milk, even if it does not show up quite so well, and the fact that it may not do so is no argument against pasteurization, a process which is a necessary safeguard for all milk supplies other than the grade known as certified

A difference of only 2° in the temperature of pasteurization throughout the thirty minutes of the process may cause a distinct difference in the cream line A temperature of 143° F does not decrease a cream line to any appreciable extent, but a temperature of 145° will reduce it by 8 per cent on the average, especially if the milk is fresh If it is old milk, the cream line seems to be restored rather than reduced by the higher temperature

For these reasons, commercial milk companies prefer to pasteurize at a temperature of 143°F, which has been shown by many scientists to be more than adequate to destroy any dangerous bacteria which might have been present in the milk, if the pasteurizing machinery is properly constructed and operated The question as to what is the correct pasteurizing temperature has caused much controversy, and there is a wide variation in the legal requirements in different parts of the country

The fat in milk is really composed of many fats, all made up of the chemical elements carbon, hydrogen, and oxygen, though in different combinations Since this book is not a treatise on organic chemistry, it will suffice to say that these fatty acids in milk bear such picturesque names as butyric, capric, caproic, lauric, myristic, palmitic, stearic, and oleic, and let it go at that

Fats play an important role in human nutrition, for

they contribute to the maintenance of health by offering a concentrated source of energy and by carrying the vitamins, or some of them, which are essential Milk fat is particularly valuable because it is readily available at a cost comparatively slight for what it gives, and it is easily digested In the form of butter, milk fat is unequalled in concentrated energy value, palatability, flavor, digestibility, and vitamin content, considering all these nutritional attributes together

VITAMIN A AND GOOD HEALTH

Of special significance is the vitamin content of milk fat, for next to cod liver oil and egg yolk, this fat is the most abundant source of the important vitamin A This vitamin was, in fact, discovered by means of milk, for in 1906 Dr F Gowland Hopkins of Cambridge, England, found that feeding experimental animals on a purified diet of casein, lard, starch, cane sugar, and mineral salts gave poor results, but when small amounts of cow's milk were added the animals began to grow and thrive instead of declining and dying From this he concluded that milk contained some substance essential to growth and good health

In this premise Hopkins was correct, though the actual discovery of the first vitamin was to come later At New Haven two scientists, T B Osborne and L B Mendel, were also studying nutrition and

they too encountered difficulties with their purified diets In Wisconsin E V McCollum and M Davis were engaged in a similar problem Then in 1913 announcements came almost simultaneously from these two laboratories that there was something in butter fat and egg yolk which does not exist in lard and common vegetable fats, and that this substance, first called "fat soluble A," next "vitamine A," and now known as vitamin A, is absolutely essential to growth, health, and life [4]

Much has been learned about this vitamin since those pioneer days in the newer science of nutrition It has been found, for instance, that the diet of the cow apparently has some effect on the amount of the vitamin in the milk Acting on this information, cows are now fed in the most effective manner by all of the prominent milk concerns It has also been shown that the human body can store vitamin A and draw on its reserve in time of need The vitamin serves not only to promote growth and to prevent the development of an eye disease, but, according to Prof H C Sherman, an abundance of it in the diet actually encourages a resistance to disease, particularly respiratory infections The desirability of having ample amounts of this vitamin in the diet is, therefore, obvious and the value of milk in this connection is apparent

[4] See also Chapter II on the Adequate Diet.

THOSE NUTRIENT PROTEINS

So much for milk fat, the value of which is now so well established. Consider next those important substances known as the proteins, whose principal function is to help build tissue in the human body, though they also have an energy value and are useful as general nutrients. Just as milk has been one of the chief instruments in aiding in the development of our knowledge of the rôles of the vitamins, so too has milk played a most significant part in contributing to our present information about proteins.

Not everything is understood about proteins as yet, but this much is certain, milk contains types of protein which are best suited for human use. In his excellent book, "Nutrition," Dr. Walter H. Eddy tells us that, "to insure the proper amount and kind of protein in the daily diet the best insurance for the layman lies in eating every day some proteins of proved quality," and he advises that, "there is no question that milk provides the best protein known to nature, and that meat, fish and eggs also contain those of good quality."

The proteins differ from the fats and carbohydrates in that, in addition to the elements carbon, hydrogen, and oxygen, they also contain nitrogen, and this nitrogen practically always comprises about 16 per cent of each protein. These compounds also frequently have a little sulphur and sometimes phos

phorus As was explained in a previous chapter,[5] there are proteins and proteins, however, and some of them are much more valuable in human nutrition than are others, chiefly because of the particular amino acids among their constituents

The principal protein in milk is casein, which averages about 1 per cent of human milk and about 3 per cent in cow's milk and goat's milk In much lesser amounts are two other proteins, lactalbumin and lactoglobulin All three of these proteins are important to man, as they contain many of the necessary amino acids, including those which the human body *must have for growth and maintenance*

Many experiments[6] have demonstrated that milk proteins are more efficient than are vegetable proteins and, in fact, that animal proteins in general are utilized to better advantage in the body than are those from vegetables and cereals This is one reason why a strictly vegetarian diet is actually less advantageous than a diet in which milk, meat, and eggs are used in a rational manner Vegetables and cereals are, of course, valuable foodstuffs for many reasons, but they should be supplemented in the diet by milk *if the best health is to be secured from* good nutrition in combination with good general hygiene

[5] See p 37

[6] They are well summarized in The Fundamentals of Dairy Science, p 457 Chemical Catalog Co, 1928

MILK SUGAR

One of the interesting phenomena of nature is the ability of an animal to form sugar in its mammary glands. This sugar, called lactose, occurs in the milks of all mammals, though there is some question as to whether that lactating leviathan, the whale, may not be an exception to the rule. The sugar in milk was first described early in the seventeenth century by a Mantuan philosopher, Fabritius Bartoletus.[1]

The lactose of all animals has identical composition and each species gives a constant amount, though the percentage varies in different animals. It is lowest, about 2 per cent, in the milk of the reindeer, and highest from 6 to 7 per cent, in human milk. In cow's milk there is an average of 4.5 per cent, or only about two thirds as much as in breast milk, and this means that cow's milk must be modified by the addition of sugar when used for infant feeding.

Strangely enough, lactose itself, which is now manufactured commercially, is not always the most suitable sugar for milk modification for infant feeding and frequently it does not give as good results as ordinary cane sugar, or sucrose. Commercial lactose is much more expensive than is cane sugar and in infants it often seems to cause fermentation and

[1] Whittier, E. O. Lactose. *Chemical Reviews*, vol. 2, p. 85, April 1925.

even diarrhea when used in large amounts It is however, often employed in combination with other sugars for this purpose, and it is, of course, perfectly assimilated in its natural condition as a constituent of milk

One of the advantages of lactose is its favorable effect in the intestinal tract, for it serves to promote the growth there of the acidophilus bacillus Lactose and dextrin are the only food sugars which can get far enough down the intestinal system to do this The consumption of liberal amounts of pure milk tends, therefore, to promote favorable conditions in the human intestine, though this is best accomplished with the aid of acidophilus milk, which is described more fully in another chapter [8]

Lactose has a slightly laxative and diuretic (urine increasing) effect, though milk itself is not laxative, but on the contrary may be slightly constipating This mild effect can be easily overcome by including fruits and roughage, such as spinach, lettuce, nuts, and whole wheat, in the diet

THE MINERALS OF MILK

The human body is made up chiefly of oxygen (about 65 per cent), carbon (about 18 per cent) and hydrogen (about 10 per cent) in various complex combinations, but the remaining 7 per cent has many

[8] See p 198

other elements, of which nitrogen represents some 3 per cent, calcium about 1 5 per cent, and phosphorus 1 per cent The residue is distributed among potassium, sulphur, sodium, chlorine, magnesium, iron, iodine, and probably a few other minerals in minute quantities

Of the fifteen essential chemical elements in the body, at least ten must be furnished in foods other than the simple fats, carbohydrates and proteins which contain only carbon hydrogen and oxygen and, in the case of the protein nitrogen and sulphur and sometimes phosphorus It is obvious therefore, that the diet must contain foods yielding all the minerals which play a significant part in the chemical and physical bodily processes known collectively as "metabolism"

Milk is particularly useful for this purpose because it contains all of the minerals found in the body It has calcium phosphorus potassium sodium, magnesium, iron chlorine iodine and sulphur, and other minerals in addition to carbon, hydrogen oxygen, and nitrogen Three of these minerals deserve special discussion because of their unusual importance These are calcium phosphorus, and iron

The framework of the body the bones and also the teeth are comprised mostly of calcium and phosphorus At all times, but especially during growth

and development, these minerals must be supplied in order to ensure the proper formation and strength of these important organs. Yet, as pointed out by Prof. H. C. Sherman some years ago, American dietaries are probably more often deficient in calcium than in any other one chemical element.

Milk not only contains liberal amounts of calcium or lime, and phosphorus, but it carries these minerals in an especially useful form. The calcium and phosphorus of milk are, in fact, better assimilated by growing children than are the same minerals in vegetables, such as carrots and spinach. These facts have been proven by scientific experiments, with children and not rats as subjects,[3] though they have been confirmed on the laboratory animals.

In order to make sure that the growing child is getting his proper share of calcium and phosphorus, he must take at least a quart of milk a day. As was pointed out in the *Journal of the American Medical Association* in commenting on Professor Sherman's notable experiments on calcium, "The dietary rule of a quart of milk each day for every child is much more than a precept based on individual opinions or drawn by analogy from the results of feeding experiments

[3] Sherman, H. C., and Hawley, E. Calcium and Phosphorus Metabolism in Childhood. *Journal of Biological Chemistry*, vol. liii, no. 2, August 1922. Also *Journal of Home Economics*, vol. xiv, no. 9, September 1922.

with lower animals, it now rests on scientific evidence obtained by extensive and intensive experiments directly upon the children themselves"

Iron is present in the body in only a small amount, about 0 004 per cent, but it has an important function, nevertheless, for it is a part of the hemoglobin of the blood which carries oxygen throughout the body Iron is also contained in the body cells, and it has other duties Food must, therefore, provide iron to replace that which is constantly being used up in the human system

Milk has about 0 00024 per cent iron What there is of it is readily utilized by the body, but there is not enough The most important sources of food iron are fruits, vegetables and whole grain cereals Eggs and lean meats are likewise high in iron, but the mineral from this source is more expensive than when it is derived from the cheaper fruits and vegetables Even though milk is relatively low in iron, that is no argument against its use in liberal amounts, for the numerous other advantages far outweigh this one slight disadvantage The low iron content is one of the few reasons why milk must be properly called "the most nearly perfect food" instead of the "perfect" food

Lack of iron causes the condition known as anemia Why is it, then, that babies who receive an exclusive milk diet during early life seldom display any signs

of anemia? The reason is because the infant gets a store of iron from the mother sufficient to carry it until it has attained to about three times its birth weight, which is usually in about twelve months Orange juice contains about the same percentage of iron as cow's milk, but prunes, spinach, and egg yolk, often given to the infant during the first year, are rich in iron There is no reason today for any baby, or adult either, suffering from anemia due to lack of iron in foods

THE VITAMINS IN MILK

In addition to its favorable content of fat, protein, carbohydrates, and minerals, milk is a rich source of the indispensable vitamins, of which six had been identified up to 1929 The presence of vitamin A in milk fat and the unique properties of this important substance have already been set forth, so that we may pass on to a brief discussion of the others in this interesting collection

As early as 1881 a German investigator named Lunin had reported that he could get better growth when he fed mice on whole milk than when he gave these animals a diet made up of milk sugar, milk fat, milk protein, and the minerals of milk As a result of his experiments he decided that "other substances indispensable for nutrition must be present in milk besides caseinogen, fat, lactose, and

salts"[14] Those substances were, of course, the vitamins, but a number of years were to elapse before another clue to their existence was found

In 1897 a Dutch physician in Java, Dr C Eijkman, discovered that the disease beri beri could be cured by substituting brown rice for polished rice in the diet In 1911 Dr Casimir Funk separated from rice bran a substance which cured polyneuritis in pigeons, this disease resembling beri beri in man In 1914, just after the fat soluble vitamine had been announced, Dr L B Mendel stated that there were in foods at least two substances which were essential to growth Then in 1915 Dr E V McCollum reported the discovery of this second factor, and designated it as "water soluble B" This substance, the same as that which Funk had found and the agent which cured beri beri, later came to be known as vitamin B

Although Professor McCollum and his co worker, Miss Davis, had experimented with polished rice, their discovery of vitamin B depended upon the fact that they could get growth in their experimental animals only when they supplemented the rice fare with milk sugar If, however, this sugar were highly purified, no growth resulted, and then they found that it was the water from which the milk sugar had crystallized that contained the growth promoting

[14] See Chemistry in Medicine p 120 The Chemical Foundation 1928

substance Hence the term "water soluble" Milk again had contributed to the newer knowledg nutrition

Until 1926 vitamin B was thought to be a si substance, but studies in that year and subseque have shown that vitamin B is really twins I made up of two factors, which in 1928 had b tentatively designated as vitamins F and G, resp tively, though other names had also been sugges Vitamin F is the anti neuritic or anti beri beri s stance and is also needed for growth, while vitami is the other growth promoter and it is also a curat for pellagra, a dietary deficiency disease often q prevalent in our Southern states Vitamin G pr ably also has other important functions in nutriti

Milk was always known to contain vitamin B, b in the past it was sometimes thought that it w relatively low in that substance Now we know th it is rich in one fraction of the vitamin, though not rich in the other It is the vitamin G part, the grow stimulator and pellagra preventive, which is the more abundant in cow's milk Human milk, on the other hand, seems to be decidedly inferior to cow's milk in its content of the vitamin B complex

While the amount of vitamin A in cow's milk may depend on the ration of the cow, the amount of vitamin B does not The cow has the unique ability to produce vitamin B in its body, accomplishing this

interesting function in the rumen, or first stomach with which the animal is provided [11] Cattle differ from human beings in possessing this rumen, or stomach, where foods are subject to bacterial changes Thus, the great importance of cow's milk as a source of the vitamin G portion of the hitherto yclept vitamin B

The existence of still another substance in fruits, vegetables and milk, which could prevent scurvy had been suspected for many years but it was not until 1919 that Dr J C Drummond in England reported experiments on this antiscorbutic which led to its designation as vitamin C Milk is supplied with this vitamin, but it is unfortunately rather easily destroyed by heat, especially in the presence of air Vitamins A and B are, however, relatively thermostable and there is little if any, loss of them when milk is heated, as in the processes of pasteuriza tion or condensing

Vitamin C is only partly destroyed in pasteurized, condensed, and dried milks, though it is absent from evaporated This vitamin is abundant in citrus fruits, such as oranges, lemons, and pineapples, in tomatoes, cabbage, potatoes, and other vegetables, and consequently may be easily supplied in the diet

[11] Vitamin B Synthesis in the Cow and the Quality of Milk Editorial p 1997 *Journal of the American Medical Association* December 22, 1928

The reason why orange or tomato juice is fed routinely to babies is to insure an adequate amount of vitamin C to prevent any possible development of scurvy

In the early work on vitamin A, it was noticed that certain foods which were well supplied with this vitamin, such as cod liver oil and butter fat, would prevent the bone disease known as rickets At first this propensity was attributed to this particular vitamin, but in 1921 McCollum explained that vitamin A could be removed from cod liver oil and yet the oil would cure rickets The presence of still another vitamin was thus indicated and this one received the cognomen of vitamin D Today we also know that the action of sunlight on the body stimulates the formation of this vitamin in the human system

Milk contains vitamin D, though there is not always enough of it to be able to prevent rickets by itself Hence the importance of giving cod liver oil and sun baths in moderation to all babies Milk does, however, yield the calcium and phosphorus which are acted upon by vitamin D in order to form good bones and teeth Vitamin D and these minerals must occur together, and so once again the value of milk in this respect is emphasized

One other vitamin remains to be mentioned This one, called vitamin E, was discovered in 1923 by Dr H M Evans of California, who had also done

some notable work in showing that vitamin A in the diet favors good reproductive powers Lack of vitamin E causes sterility in rats, but the vitamin is not of much practical significance to man, because it is widely distributed in nature, and ordinary food probably furnishes plenty of it to prevent sterility Milk contains vitamin E and experiments have indicated that the E content of milk is adequate where this food constitutes a large proportion of a diet not too high in fat

Our knowledge of the vitamins is not yet complete A vast amount of information about these essential substances has been developed, but even more will be known in the future and brilliant results in vitamin research may be expected Already there are indications that the old vitamin B has a third factor and by the time this book appears or is even a few months old, new vitamin discoveries may have been announced Based on previous experiences, it seems likely that milk will hold its own in this field

MILK AND THE TEETH

The possession of good teeth depends not upon mechanical cleaning of these important organs, but upon their feeding In other words, good teeth are developed and maintained by means of a proper diet This may be supplemented by mouth hygiene, but it is nutrition which is the primary factor in the production of the best teeth

This nutrition of the teeth must begin before we are born, for the teeth commence to form about the fourth month of pregnancy. The expectant mother who gets a good diet, with plenty of milk to provide the necessary tooth building minerals, and with adequate fresh air and sunshine and other measures included in good hygiene will do her offspring the great favor of conferring good teeth upon him, her, or them.

This good diet of the mother must continue during the nursing period and then the child itself must be properly and efficiently fed during its early years if fine teeth are to be produced. Milk must be the basis of this diet, of course, but cod liver oil and sunlight are also important. If attention is paid to these factors from childhood throughout life, practically nothing can injure the teeth, except accidental blows, and dental decay will be absent or minimized.

There is no sound basis for the statement sometimes encountered that sweetened condensed milk will cause bad teeth because of its sugar content. If the diet of the mother while pregnant and nursing has been proper and if the diet of the baby is supplemented with cod liver oil and he is raised in a reasonably hygienic manner, the amount of sugar in sweetened condensed milk, which is only moderately higher than that in modified whole milk, will have no deleterious effect on the teeth. The same may be said of white

bread, which has been wrongly accused by certain food faddists of causing all sorts of human ills

THE FUEL VALUE OF MILK

A quart of milk yields on the average 675 calories, or about 314 calories per pound. This is 69 calories per 100 grams and about 690 calories per liter. Approximately 19 per cent of these calories are supplied by the milk protein. The large amount of water, about 87 per cent normally present in whole milk, reduces the caloric or fuel value. The bulk of milk, is, in fact, another one of the few reasons why it must be called nearly perfect instead of perfect as a food.

Condensed and dried milks, with a lower water content have, of course, a higher caloric value than does whole milk. Thus, powdered milk has about 149 calories per ounce and a 15-ounce can of sweetened condensed milk (42 per cent sugar added) yields a total of about 1870 calories. An ordinary 16 ounce can of evaporated milk would give about 680 calories.

Since the average number of calories needed by adult individuals varies from 2000 to 6000 a day, depending upon the size, activity, and other factors, it will be seen that at least 3 quarts of pure whole milk a day would be needed for a person living on an exclusive milk diet. Such a diet could, however, be supplemented with cream or sugar, or with other

energy yielding substances An interesting experiment has been reported[12] in which 8 subjects consumed 4 quarts of milk a day for 1 month, using milk to which gelatin had been added during alternate weeks All continued in excellent health throughout the test

THE DIGESTIBILITY OF MILK

Milk is one of the foods which is easily and completely digested by most persons The ease with which any food is digested depends upon a number of important factors, including its composition, the way it is mixed with other foods, the manner of cooking, the condition, mental state, general hygienic practices, and the idiosyncracies of the individual

Few foods are actually indigestible, but there is considerable variation in the so called coefficient of digestibility of different foods This figure represents a scientific determination of the amount of food absorbed and is arrived at by feeding a measured quantity between two insoluble colors and then computing the amount passed in the feces If, for example, 100 grams of food are consumed and 40 grams appear after the suitable interval in the feces, the coefficient of digestibility is expressed as the difference divided by 100, or in this case 60 per cent

[12] Neff A Exclusive Milk and Gelatinated Milk Diets *Medical Journal and Record*, July 18, 1928

with another, cabbage with another, and so on A person who for any reason cannot take whole milk often can consume powdered or malted milk without difficulty, or may get the desirable amount of milk in cooked foods Such few individuals should try the various forms of milk until one is obtained which causes no trouble

Milk is sometimes thought to be fattening, but this is not the case when the rest of the diet is properly adjusted Since a pint of milk contains about 340 calories, it can readily be seen that this daily quota for an adult yields only a small proportion of the 2000 or so calories which the reducing person may consume each day Butter and cream may, however, assist in putting on weight, as may also milk when used in large quantities or in addition to an already abundant diet

HOW MUCH MILK EVERY DAY?

It has frequently been pointed out in this book that a quart of pure milk in some form is desirable and necessary to promote and maintain the growth, health, and physical efficiency of every child, at least to the age of twelve This quantity has been determined by scientific experiment as the minimum and is agreed upon by all progressive physicians and nutritional experts

This quantity is none too much for the adult,

though a pint of milk a day is generally recommended A pint means only two glasses Every grown person would be benefited by making it a practice and a habit to drink a glass of milk at two of his meals every day The day when milk drinking was considered effeminate or juvenile has long since passed and the term "milk sop" is no longer one of derision, but of admiration Men like Jack Dempsey, Gene Tunney and Charles A Lindbergh, who are all said to be heavy milk drinkers, can hardly be called "milk sops" in the sense that the term was used a century ago

MILK THE PROTECTIVE FOOD

Milk and green vegetables have been called "protective foods" by Prof E V McCollum, because they serve to supply the deficiencies of other foods No other article of the present human diet equals milk in value and very few even approach it Every food has some defects from the nutritional standpoint, but if the diet is made up with milk, green vegetables, and fruit as the customary basis, these defects are readily surmounted

"Milk," says *New York Medical Week* for January 12, 1929, "represents a public necessity An almost perfect food, it is the indispensable sustenance of childhood Anything that interferes with the purity or adequacy of the city's milk supply is indeed a menace"

CHAPTER V

How to Get Clean and Safe Milk

It is a strange thing that nature's most valuable food may at times also be one of the most dangerous We have long known that milk may become a medium by which serious infectious diseases may be spread, but only of recent years have we had a proper appreciation of the potential danger of disease distribution in uncontrolled and ineffectively supervised milk supplies When milk is pure, that is, clean and safe, it is indeed the most nearly perfect food, but dirty and contaminated milk is certainly not in that category The sanitary production of milk is an absolute necessity, not only to enhance its food value, but also for the general protection of the public health

DISEASES SPREAD BY IMPURE MILK

The first reported outbreak of disease due to an impure milk supply was a typhoid epidemic which occurred in Penrith, England, in 1857 It was traced by a Dr M W Taylor, who also ran down a scarlet fever epidemic a few years later In 1881 another English physician, Dr E Hart, collected data on a considerable number of epidemics attributed to

polluted milk Among them were 50 typhoid epidemics, 15 of scarlet fever, and 4 of diphtheria [1]

One cannot contemplate with fortitude the hundreds of recorded epidemics of serious infectious diseases that have been definitely established as milk borne and the unknown other hundreds, the origin of which have not been recorded owing to the lack of epidemiological study of this group of epidemics According to a study by two officers of the United States Public Health Service, there have been since 1909 some 700 recorded outbreaks of disease due to polluted milk supplies [2] Fortunately the sanitary supervision of milk has been growing more effective during recent years, though much remains yet to be done

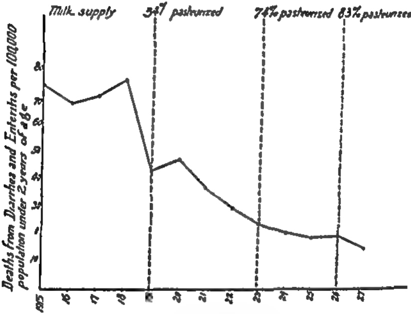
The greatest typhoid fever epidemic of modern times, occurring in Montreal, Canada, in 1927, involving 5002 cases and 533 deaths,[3] and a serious septic sore throat epidemic of Lee, Massachusetts occurring in 1928, in which there were about 1000

[1] North C E Milk and Its Relation to Public Health In A Half Century of Public Health American Public Health Association 1921

[2] Armstrong C and Parran T Further Studies on the Importance of Milk and Milk Products as a Factor in the Causation of Outbreaks of Disease in the United States Supplement No 62 1927 United States Public Health Service Washington D C

[3] From February to August 1927 See *American Journal of Public Health* for August 1927, for description of this epidemic

cases and 45 deaths, are sad but challenging conditions to which milk producers and distributors as well as health officials must give their best thought and efforts if such tragedies are to be prevented in the future



DEATHS FROM DIARRHEA AND ENTERITIS UNDER TWO YEARS OF AGE IN MASSACHUSETTS, 1915–1927

Then there are the diarrheal diseases and deaths of bottle fed infants, due in the main to contaminated milk, which continue to be an important factor in the morbidity and mortality of babies under one year of

age One of the most striking phenomena of public health administration is that when a city's milk supply is effectively pasteurized there is an immediate reduction of cases and fatalities from diarrhea and enteritis in infants

TABLE 7
MILK BORNE EPIDEMICS 1924–1927*

DISEASE	NUMBER OF EPIDEMICS					
	Total 1924–1928	1924	1925	1926	1927	1928
Total—all milk borne diseases	237	43	44	69	29	43
Diphtheria	10	2	2	3	2	1
Scarlet fever	30	6	6	4	4	10
Septic sore throat	13	1	5	4		3
Typhoid fever	167	33	30	54	26	24
Malta fever	6				3	3
All others	11	1	1	4	3	2

* Reported by State and Provincial Health Authorities

When we consider that approximately 50 per cent of our population are still dependent on milk supplies which have no continuous or effective supervision or control, we should not be surprised at the inevitable results which follow such neglect [4]

While important advances have been made in the

[4] Crumbine [illegible] J and Holland [illegible] A Survey of Small Town Milk Supplies *Child Health Bulletin* November 1927

cause of clean and safe milk, especially in the larger cities, through improved sanitation of production and effective pasteurization of milk supplies, yet much remains to be accomplished in further minimizing the hazards in relation to milk-borne disease, as the record of milk-borne diseases for the last five year period (1924–28) now available will emphasize (see table 7)

HOW PURE MILK REDUCES DISEASE

That effective milk control does greatly reduce that portion of infant mortality due to diarrhea and enteritis is shown by the experience of a number of American cities, such as Cincinnati Detroit, Chicago and New York The striking reduction in deaths of children under two years of age from diarrhea and enteritis since 1910 in the United States Registration Area is undoubtedly due in large measure to the increasing amount of pasteurized milk available for infant feeding This decline by five year intervals is shown in table 8

We recognize that there are a number of other important factors that are entitled to a large place among those chiefly responsible for the reduction of diarrhea and enteritis in infants, such as improved medical care, the teaching given by the public health nurse, better sanitation, higher economic conditions, and increased knowledge of
general public health instruc

of health of Toronto, Canada, Dr C J Hastings, in his Report No 11, for September, 1927, states that

One of the most striking decreases in the past fourteen years is the number of infant deaths from gastro-intestinal diseases In 1913 27 per cent of all deaths under one year of age was due to this cause In 1926 this figure was reduced to 9 per cent

TABLE 8

AVERAGE DEATH RATES FROM DIARRHEA AND ENTERITIS (UNDER TWO YEARS) FOR FIVE YEAR PERIODS FROM 1906–1925, UNITED STATES DEATH REGISTRATION AREA*

YEARS	DEATH RATES FROM DIARRHEA AND ENTERITIS (UNDER TWO YEARS) PER 100 000 POPULATION UNITED STATES DEATH REGISTRATION AREA
1906–1910	96 2†
1911–1915	69 8
1916–1920	55 4
1921–1925	33 2

Rates from Mortality Statistics United States Bureau of the Census 1906–1925

† Average figure from Mortality Reports For other years average was calculated from rates for individual years

Chlorination of the city water, which was begun in March 1910 the introduction of compulsory pasteurization of all milk on June 1st, 1914 accompanied by the ever widening instruction of mothers as to the dietary requirement of their children marked the turning point.

The accompanying chart depicts this reduction in a graphic manner

When it is considered that practically all milk in

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1916–1920	55 4
1921–1925	33 2

* Rates from Mortality Statistics United States Bureau of the Census 1906–1925

† Average figure from *Mortality Reports* For other years average was calculated from rates for individual years

Chlorination of the city water which was begun in March 1910 the introduction of compulsory pasteurization of all milk on June 1st 1914 accompanied by the ever widening instruction of mothers as to the dietary requirement of their children marked the turning point.

The accompanying chart depicts this reduction in a graphic manner

When it is considered that practically all milk in

cause of clean and safe milk, especially in the larger cities, through improved sanitation of production and effective pasteurization of milk supplies, yet much remains to be accomplished in further minimizing the hazards in relation to milk borne disease, as the record of milk borne diseases for the last five year period (1924–28) now available will emphasize (see table 7)

HOW PURE MILK REDUCES DISEASE

That effective milk control does greatly reduce that portion of infant mortality due to diarrhea and enteritis is shown by the experience of a number of American cities, such as Cincinnati Detroit, Chicago and New York. The striking reduction in deaths of children under two years of age from diarrhea and enteritis since 1910 in the United States Registration Area is undoubtedly due in large measure to the increasing amount of pasteurized milk available for infant feeding This decline by five year intervals is shown in table 8

We recognize that there are a number of other important factors that are entitled to a large place among those chiefly responsible for the reduction of diarrhea and enteritis in infants, such as improved medical care, the teaching given by the public health nurse, better sanitation, higher economic conditions, and increased knowledge of personal hygiene through general public health instruction. The medical officer

of health of Toronto, Canada, Dr C J Hasting
his Report No 11, for September, 1927, states tha

'One of the most striking decreases in the past fourteen ye
the number of infant deaths from gastro-intestinal diseases
1913, 27 per cent of all deaths under one year of age was due t
cause In 1926 this figure was reduced to 9 per cent

TABLE 8

AVERAGE DEATH RATES FROM DIARRHEA AND ENTERITIS (U
TWO YEARS) FOR FIVE YEAR PERIODS FROM 1906–1925,
UNITED STATES DEATH REGISTRATION AREA*

YEARS	DEATH RATES FROM DIARRHEA A ENTERITIS (UNDER TWO YEARS) 100 000 POPULATION UNITED ST DEATH REGISTRATION AREA
1906–1910	96 2†
1911–1915	69 8
1916–1920	55 4
1921–1925	33 2

* Rates from Mortality Statistics, United States Bureau
Census 1906–1925

† Average figure from Mortality Reports For other
average was calculated from rates for individual years

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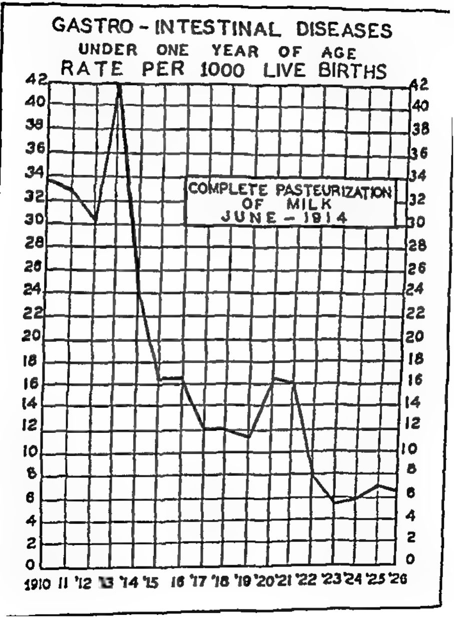
GASTRO - INTESTINAL DISEASES
UNDER ONE YEAR OF AGE
RATE PER 1000 LIVE BIRTHS
COMPLETE PASTEURIZATION OF MILK JUNE - 1914
42 40 38 36 34 32 30 28 26 24 22 20 18 16 14 12 10 8 6 4 2 0
1910 11 '12 '13 '14 '15 16 '17 '18 '19 '20 '21 '22 '23 '24 '25 '26

Toronto is now pasteurized, one of the chief reasons for the great diminution in infant mortality in this city is readily apparent The increase in the proportion of the milk supply that was subject to pasteurization in the city of Toronto, Canada, is shown in table 9

Perhaps the most striking example of the imme diate effect in the reduction of diarrheal diseases

TABLE 9

RESULTS OF MILK PASTEURIZATION IN TORONTO CANADA

	1911	1921
	per cent	*per cent*
Pasteurized milk	35	99 7
Certified milk	1	0 3
Raw milk	64	nil

of infants by the pasteurization of the milk supply is that which occurred on Randall's Island, New York, in a children's institution, where a mortality of 44 36 was promptly reduced to 19 80 after all the milk was pasteurized, no other hygienic measures being put into operation

Another excellent example of an apparent correlation between the reduction of fatalities from diarrhea and enteritis is that in Massachusetts where the increase of pasteurization of the milk supplies and the accompanying decline in these deaths is graphically shown in the accompanying chart (p 112)

HEALTHY CATTLE ARE NECESSARY

In addition to the possible dangers to which milk may be subjected by contamination from human sources in the course of its production, distribution, and sale, there is another potential danger—the dairy cow, *considerable numbers of which suffer from* bovine tuberculosis and infectious abortion Tuberculosis in cattle is said to be one of the oldest known diseases of animals

Before the campaign for eradication of tuberculosis was undertaken on an extensive scale, herd infection was widely prevalent, but now, after intensive campaigns for eradication have been conducted throughout the country, the United States Bureau of Animal Industry reports that the per cent of cattle reacting to tuberculosis has been reduced from 4 9 per cent in 1918 to 2 3 per cent in 1928, and the number of accredited herds, that is, those containing cattle free from tuberculosis, *increased during the* same period from 204 in 1918 to 177,532 in 1928

This extensive and intensive tuberculosis eradication work, carried on cooperatively by the federal and state governments, together with the increased supply and use of pasteurized milk has greatly minimized the dangers from bovine tuberculosis infection by the use of raw milk

After painstaking research, it was found by investi

gation that of cases of children under five years suffering from tuberculosis, 21 per cent were of the bovine type of infection, that of cases of tuberculosis among children between the ages of five and sixteen years, 26 per cent were of the bovine type, while the percentage of cases of this type in adults over sixteen years of age was only 1 6[4] This type of tuberculous infection in children has, however, been greatly reduced in those cities where the sale of pasteurized milk has been made compulsory

If recent estimates can be accepted as being fairly accurate, the annual losses to the cattle industry from contagious abortion reach the staggering total of $50,000,000 The disease seems to be widely spread throughout the entire United States and must therefore be considered in all effective plans of milk control

The Chief of the United States Bureau of Animal Industry has stated that while the general losses to the cattle industry ten years ago (1918) are about equal to those of today, the losses from tuberculosis during the past ten years have been reduced about one-half, while the losses from contagious abortion have about doubled

[4] Park W H and Krumwiede C The Relative Importance of the Bovine and Human Types of Tubercle Bacilli in the Different Forms of Tuberculosis *Journal of Medical Research* vol 27, p 111 Boston September 1912

From the increasing number of human cases of so called Undulant Fever (*Brucella abortus* infection) that have been studied epidemiologically, there seems to be evidence that this disease may be milk borne A similar disease, known as Malta fever, may be conveyed to man by raw milk from an infected goat, the organism causing the trouble being known as *Brucella melitensis* As goat's milk is not widely used in the United States, Malta fever or *Brucella melitensis* infection does not have as much public health and economic interest as does the contagious abortion, or *Brucella abortus* infection of cattle, on the other hand in certain countries of southern Europe and northern Africa, Malta fever may be of considerable significance The proper pasteurization of milk prevents the possibility of the spread of undulant fever and Malta fever

From the foregoing consideration of the possibility of disease dissemination by milk contaminated from human or animal sources, the problem of safe and clean milk production and distribution obviously is one of great public health importance Recognition of this fact by states and municipalities has resulted in the enactment of laws and ordinances providing for the supervision and control of production and distribution of market milk [4]

[4] Tobey James A, Public Health Law The Williams & Wilkins Co, 1926

PURE MILK IS GOOD BUSINESS

However compelling legal requirements for the production of clean and safe milk may be, the economic motive and self interest of the producer and distributor may always be of even greater force, because human conduct in the main is motivated by self interest It is unquestionably a fact that when properly understood, reasonable legal requirements and the supervision of milk supplies promote the economic interests of the dairy industry, and all of the larger milk companies in our big cities now endeavor to outdo one another in producing milk of the highest quality It is realized that better quality and safety of milk are important factors in increased consumption of milk by the public Besides, clean milk reduces waste from spoilage, with more profits to the industry

The increasing degree of mutual cooperation between those engaged in the milk industry, and the milk control officials is convincing evidence of the recognition of this principle by all parties concerned Nor has this principle operated only in restraint of those engaged in the milk industry Milk control officials, in general, have become less like policemen and prosecutors and more like instructors and helpers, less like fundamental dogmatists and more like sympathetic workers in a common field of usefulness

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Thus we find these groups meeting in conference or convention without prejudice or rancor to discuss and confer concerning the most approved methods for the production and distribution of clean and safe milk. Such a spirit of cooperation and mutual confidence has done much to improve both the quality and quantity of the milk supply in communities and cities where it has existed. In the future it will even do more when producers, dealers, and officials really sense the fact that in sane and reasonable milk control the interests of producer and consumer run in parallel lines toward a common goal, the increased consumption of clean and safe milk.

THE LEGAL CONTROL OF MILK

The earliest milk control laws and ordinances related chiefly to adulteration by the addition of water; later the definition of adulteration was broadened to include the addition of preservatives or the removal of part of the cream by skimming or otherwise. At still a later date certain prohibitions and requirements relating to sanitation, bacterial counts of the milk, cooling, storage, handling, and distribution of milk, the establishment of grades of milk, the tuberculin testing of dairy cattle, the care of dairy utensils and bottles and the health of dairy employees have all received consideration in modern milk control ordinances.

Attempts to regulate or control public milk supplies were made long before sanitary science had been established, according to one writer,[7] who tells us that as early as 1599 the city of Vienna prohibited the sale of milk and dairy products because they were thought to have been the cause of an epidemic of that period This same author cites an old record of the eighteenth century, which said, "Milk from old cows is not good, good milk is either white or yellow, not green or blue Cows must be properly fed and straw cleaned, milkmaids must keep themselves clean and utensils must be clean Unclean milk turns sour" How modern this sounds

Shakespeare, it will be remembered, said, "She can milk, look you, a sweet virtue in a maid with clean hands" (*Two Gentlemen of Verona*, III, 1–268), which is an excellent commentary on dairy sanitation A milk ordinance regulating the keeping of cows and goats was adopted in Paris in 1743 The first real English milk law was passed in 1860 and in 1866 a large London dairy voluntarily adopted its own strict regulations for the sanitary production of milk In 1864 the City of Boston, Massachusetts, prohibited the sale of milk from diseased cows and this metropolis had already appointed a milk inspector in 1859,

[7] King W F Control of Public Milk Supplies *Journal of the American Medical Association*, vol 91, p 552 August 25 1928

authorizing the collection of samples at the same time

The first bacterial counts of milk were made in Boston in 1892 under the direction of the late Prof William T Sedgwick of the Massachusetts Institute of Technology In this same year Nathan Straus established his famous milk stations in New York City and in order to secure high quality milk was advised by Drs A Jacobi and R G Freeman to sterilize the milk by boiling it for at least half an hour Dr Jacobi had made a similar suggestion regarding the New York milk supply in 1873, and in 1886 a German physician, Dr Soxhlet, had adopted this procedure as a routine It was the forerunner of pasteurization

During the twentieth century many milk control laws and ordinances were adopted Milk legislation has culminated, more or less, in the Standard Milk Ordinance, proposed by the United States Public Health Service In cooperation with state departments of health, this federal bureau has been promoting and urging during the six years prior to 1929, and with considerable success the adoption of a uniform standard milk control ordinance or code By the end of 1928 thirteen states had adopted this code as a workable model for the municipalities of their respective states, and during this same period over 200 cities had passed the standard ordinance in

all essential particulars While there is some question in the minds of many leaders in the dairy industry and those who are concerned with its sanitation as to whether we are ready or able to draft a universally applicable milk ordinance,[8] the Standard Ordinance seems to have worked successfully in many sections of the country

THE STANDARD MILK ORDINANCE

The fundamental elements of the Standard Ordinance proposed by the United States Public Health Service are as follows [9]

1 It recommends for passage by cities a Standard Milk Ordinance

- (a) which lists the precautions under which Grade A Raw and Grade A Pasteurized Milk shall be produced and pasteurized and which permits such supplies to be labelled Grade A Raw and Grade A Pasteurized, respectively
- (b) which requires that milk supplies which are repeatedly found not to be protected by every one of these precautions shall be degraded by the health officer and required to carry lower grade labels
- (c) which requires that the grades of all dairies and plants must be determined and announced at least once every

[8] Report of the Committee on Milk Ordinances p 204 Seventeenth Annual Report International Association of Dairy and Milk Inspectors 1928

[9] Frank L C Seventeenth Annual Report p 136, International Association of Dairy and Milk Inspectors 1928

six months and that all grades awarded must be based upon field inspections and laboratory analysis made subsequent to the immediately preceding announcement of grades

(d) which leaves to each community the decision as to which raw grades shall be permitted to be sold raw to the final consumer, but frankly urges as much pasteurization in each community as public opinion will support.

2 *It recommends that the State Board of Health detail periodically* a qualified milk specialist to visit each city and survey the milk control work and results

(a) so as to promote uniform inspection, laboratory and grading work throughout the State and
(b) so as to measure the excellence of the results obtained in each community

It may be conceded that if the provisions of the standard milk ordinance, or one of similar requirements, are faithfully carried out a clean milk supply may be assured A clean milk quickly cooled and bottled and delivered in compliance with the provisions of the ordinance and modern sanitary practice goes a long way toward the production of a safe milk In some parts of the country, however, requirements are now and have been for many years more stringent than those of the Standard Ordinance

PRINCIPLES OF MILK SANITATION

The production of pure milk, that is, milk which is both clean and safe, depends upon a number of important factors Good equipment is of some

significance, but intelligent methods are even more vital. The five most significant factors are (1) healthy cattle, (2) healthy workmen, (3) sterile utensils, (4) sanitary methods, and (5) immediate cooling of the milk after it is drawn and keeping it cool. Adequate attention to these fundamental principles should ensure a clean milk supply. Complete safety is then obtained by proper pasteurization.

Cattle. The cows from which market milk is secured should be healthy and free from tuberculosis, mastitis, or other diseases. They ought to be examined at least once a year by a competent veterinarian and as much oftener as practicable. If the milk is to be sold raw, every cow should first be given the tuberculin test by a licensed veterinarian and all reactors removed from the herd. Such cows should also be given a thorough physical examination once a month.

Milk should not be used from cattle within fifteen days of calving or five days thereafter, as such milk contains or is likely to contain colostrum, which has a detrimental effect on the digestion, especially of infants.[13]

Dairy barns. The barns and stables in which cows are kept should be well lighted and ventilated. Floors, walls, and ceilings should be tight and kept

[13] See p. 51.

clean Manure should be frequently removed and so disposed of as to be inaccessible to cattle and in a manner which will prevent fly breeding

Milk houses Rooms for handling and storing milk should be provided separately from the dairy barn They should be constructed of impervious material, well drained, and kept clean An ample supply of pure water should be available

Utensils All milk pails, cans, bottles, and other utensils must be made of smooth non absorbent material and so constructed as to be easily cleaned The cleansing process between each usage should employ boiling water, or chlorine solutions and after proper sterilization the utensils should be stored and handled in a manner to prevent contamination

Methods of milking Before cows are milked, their flanks, udders, and teats should be cleaned Milkers' hands should be clean at the time of milking and they should milk with dry hands Clean clothing is desirable and milk stools should likewise be free from dirt Each pail of milk ought to be removed at once from the dairy barn to the milk house, where it may be strained through clean materials only, and where it should be cooled immediately to a temperature of 50°F or less and kept at that temperature until delivered

Market milk should preferably be put into sterilized glass bottles for delivery and this process of bottling

is best accomplished by machine The bottles are also capped by machinery The so called dipped milk, that which is poured into large cans in a store and then dispensed by a dipper to each customer, is invariably dirty and unsafe because of many sources of contamination

The workers The entire personnel employed on a dairy should be free from disease or the possibility of carrying disease At least once a year each worker should be examined by a competent physician No matter how much care may be taken in other ways, a carrier of typhoid fever, or a person ill with diphtheria who acts as a milker or in some capacity in connection with the handling of milk may infect the supply and if it is not subsequently pasteurized an epidemic may result Many an outbreak of disease in a raw milk supply has been traced to a carrier of the disease on the farm

PREVENTING FLAVORS AND ODORS

Pure milk is palatable and has a pleasant taste Occasionally a milk will have an abnormal flavor and will be rejected by the dealer Such flavors and also odors may be due to an abnormal condition of the cow, but most often are caused by the nature of her feed Odors may, of course, be absorbed by the milk after its production and care must be taken to prevent this occurrence

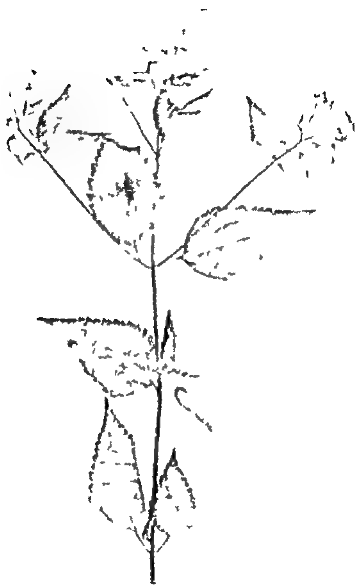
According to the United States Department of Agriculture,[11] the feeds which do not affect the flavor of cow's milk are green corn, green oats and peas, green soy beans, pumpkins, and sugar beets. The flavor is only slightly affected by green rye, green cowpeas, potatoes, dried beet pulp, and carrots, but it is markedly influenced by green *alfalfa*, cabbage, turnips, rape, and kale if fed one hour before milking. Wild onions may also cause much trouble. In most cases the flavor remains for only a few hours after feeding.

Weeds may be the cause of some objectionable flavors and odors in milk. Garlic is one of the most pestiferous of these weeds and cows must be removed from pastures infested with this succulent plant, or else the plants must be completely eradicated, a matter of some difficulty.

MILK SICKNESS

Certain plants may cause serious disease in cattle and man when milk is used from cattle which have ingested these plants. This milk sickness was formerly quite common, but is now fortunately relatively rare. It has occurred occasionally in the mid west, but seldom in the east.

[11] Babcock, C. J. Preventing Feed Flavors and Odors in Milk. Leaflet No. 25. 1928. United States Department of Agriculture, Washington, D. C.



THE SNAKEROOT

Richweed or white snakeroot (Eupatorium urticaefolium) from the *Journal of Agricultural Research* vol 35 no 6 September 15

When Abraham Lincoln was a boy of seven, his family moved from Kentucky to southern Indiana, locating on the Ohio River near Little Pigeon Creek. In this neighborhood there grew and flourished a plant called snakeroot or squaw weed which was eaten by the cows, whose milk thereupon produced a serious malady. In 1818 Nancy Lincoln, Abraham's mother, succumbed to this disease, as had also her aunt and uncle, Betsy and Thomas Sparrow and a cousin, Dennis Hanks. In 1830 the disease appeared again, and the Lincolns promptly migrated.

The white snakeroot which causes this trouble is scientifically known as *Eupatorium urticaefolium*. It grows in woodlands and deep valleys, particularly in shady places.[11] A goldenrod in the Southwest called *Aplopappus heterophyllus* also causes the disease, which is known as "trembles" in animals and Milk Sickness in man. As previously stated, this malady is seldom encountered nowadays, and practically never causes trouble in any large city supply of market milk.

[11] Bulger H A, Smith F M, Steinmeyer A, Milk Sickness and the Metabolic Disturbances in White Snakeroot Poisoning, *Journal of the American Medical Association*, vol 91, p 1964, December 22, 1928. See also Couch J F, Milk Sickness the Result of Richweed Poisoning, *Journal of the American Medical Association*, July 28, 1928.

companies should all be educators who teach dairymen the art of clean and safe milk production

The better the grade of milk, the more it is worth The big milk concerns must recognize this fact and pay accordingly for cleanliness and quality in the supplies they purchase from individual farmers In the United States many large concerns have a system of payments based on bacteria counts The lower the number of organisms, the higher the compensation Milk below a certain standard is, of course, rejected entirely, but this method of dealing with farmers has given such good results that very little milk has to be refused and more than 85 per cent of it is of the highest quality when received from the farmer Regulation and education have been and still are used, but payment, a factor which influences a man's economic status, seems to be the most potent inducement to sanitation and hygiene [11]

CERTIFIED MILK

In 1892 Dr Henry F Coit of Newark, N J, induced the Essex County Medical Society to appoint a committee to supervise the production of certain milk and "certify" as to its purity In 1901 Dr Henry Dwight Chapin got a similar system under way in New York City From this beginning has grown

[11] Holford F D Obtaining a Quality Milk Supply *Milk Plant Monthly*, May 1929

the present organization of Medical Milk Commissions of County Medical Societies which supervise the production of Certified Milk. This is the only raw milk which is not a potential danger and there are even those sanitarians who advocate the pasteurization of this undeniably clean milk. A milk called, or perhaps miscalled, "Pasteurized certified" was, in fact, placed on the market and advertised in 1929. Because of the many stringent rules for its production, certified milk is always the most expensive.

PASTEURIZATION

Even under the most approved practice in milk production and distribution we have human frailty and error in judgment and practice to deal with, besides unforeseen accidents quite beyond ordinary human control that may lead to serious milk contamination. It should be remembered, too, that infectious sickness of dairy cow or dairyman may occur in unknown and unsuspected ways, that even the compliance with the provisions of the strictest ordinance may not prevent, and thus an otherwise wholesome milk supply be dangerously contaminated.

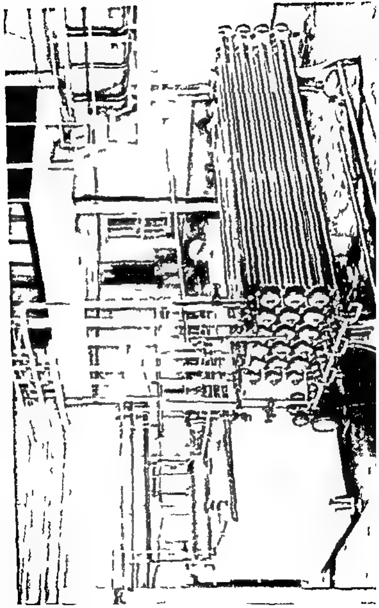
For these and other reasons, thoughtful sanitarians and milk distributors have generally agreed that the only way to assure a wholesome, palatable, and at the same time *safe* milk supply is by the process known as pasteurization. By pasteurization is meant the

heating of every particle of milk to a temperature of from 142° to 145°F and holding at that temperature for thirty minutes, after which the milk is rapidly cooled to a temperature of 45° to 50°F and then bottled in sterile bottles This process will assure a safe milk

Proper pasteurization destroys all pathogenic bacteria in milk and so renders it safe The most resistant of the dangerous microorganisms in milk is the tubercle bacillus, which is readily killed at the pasteurizing temperature The pasteurization machinery must, of course, be kept clean, and so constructed that it has no dead ends or pockets which allow opportunities for contamination

Proper pasteurization is not and never will be intended to take the place of sanitary control of milk production Pasteurization will not make a poor milk good, although it may be considered safe from a disease dissemination standpoint

Pasteurization does not change the physical quality of the milk, it is not rendered less digestible, but on the contrary more digestible as the process lessens somewhat the tension of the milk curd It does not lessen the amount of cream, although if the milk is heated at a temperature above 145° the cream line is affected Pasteurization does not appreciably affect the vitamins in which milk is rich, although vitamin C is somewhat reduced in potency after pasteurization



The wholesomeness and safety of pasteurized clean milk has been slow in popular recognition, especially in the smaller groups of cities and towns, though this may be due chiefly to the erroneous belief or fear that pasteurization in some way injures milk as a food for children, especially for babies

In a paper presented by Dr Warren F Fox, health officer of Pasadena, California, before the International Association of Dairy and Milk Inspectors meeting at Chicago in 1928, he presented the views of many authorities on the use and value of pasteurized milk These authorities, he states, are nationally and internationally known and include pediatricians, bacteriologists, sanitarians, physiologists, health officers and others This information was gathered through a questionnaire and the replies to the questions are tabulated and quoted from Dr Fox's paper as follows

	Yes	No	No answer
1 Is pasteurized milk a good milk for babies?	72	1	6
2 Do you consider certified milk to be more suitable for infants and growing children than pasteurized Grade A milk?	13	41	25
3 Does raw milk have greater nutritive value in infant feeding than pasteurized?	12	42	25
4 Do you think certified milk should be pasteurized and if so what should be the extent of the heat treatment	55	10	14

It would seem, therefore, that from our present knowledge the main objective in milk production and control is the production of a maximum amount of milk from healthy non reacting tuberculin tested cows under approved sanitary conditions, all of which, with the possible exception of certified milk, should be pasteurized It should then be quickly cooled to 45° to 50°F and bottled in sterile containers Such milk is both wholesome and safe

Whenever improvement in milk supplies has been brought about, there has been a corresponding progress in public health Better milk, together with the education of mothers in child hygiene, invariably means a reduction in infant mortality The greater consumption of pure milk in some form always results in an increase in the vitality of the people, with an accompanying enhancement of their efficiency and happiness

CHAPTER VI

WAYS OF USING MILK

Since milk is the most nearly perfect human food, it is a nutriment for all persons at all ages Not only is it "brute's food" as a German chemist of another generation alleged, but it is sustenance for the delicate and the robust alike, for the old and the young, for man, woman, and child In this chapter will be given some practical suggestions for the use of milk by various classes and types of persons, so that they can derive the most benefit from this necessary part of their diet

Milk is a food found agreeable by most persons, but it can be made attractive to nearly everyone There are, of course, a few individuals who have an idiosyncracy to milk, just as some people can not eat certain foods without possible unpleasant results Persons who cannot take whole milk often can consume the concentrated milks, such as the evaporated or powdered, or malted milk, or they may get milk in cooked foods In another chapter many practical recipes using milk are presented [1]

[1] See p 226

Let us start from the beginning and trace briefly the proper use of milk along the highway of life [1]

MILK AND FERTILITY

To begin at the beginning we must consider the effect of milk on reproductive processes There are, of course, many factors in fertility, but good nutrition is certainly one of them It has been shown, for instance, that an abundance of vitamin A in the diet tends to promote fertility, while another vitamin, called vitamin E, has likewise been demonstrated to influence gestation The notable experiments of Prof H C Sherman with laboratory animals, in which the prime of life has been extended in both directions by increasing the amount of milk in an already adequate diet are described elsewhere in this book [2]

Not only vitamins A and E, but also one fraction of vitamin B has been discovered to have an effect on gestation Now vitamin E is not of great practical importance to man because it is widely distributed in nature, especially in flesh foods such as meat, and it is seldom lacking in an ordinary diet Vitamin A must, however, be secured in abundance as an aid to

[1] Tobey James A The Quest for Health Funk & Wagnalls 1924 Contains a discussion of general hygiene on life's highroad.

[2] See p 13

reproduction, and vitamin B is also desirable for this purpose

Milk fat is rich in vitamin A and milk is likewise an excellent source of the vitamin G (sometimes called P-P or B_2) portion of the vitamin formerly known as B, it is a fair source of the other fraction, now usually known as vitamin F Other factors being equal, therefore, it is entirely proper to conclude that plenty of milk in the diet will assist in the promotion of fertility This does not mean necessarily that a person who is so unfortunate as to be sterile can start to imbibe huge quantities of milk and immediately or quickly become capable of producing children It does mean that a continuous diet of pure milk throughout life, along with other satisfactory nutriments and proper personal hygiene, will be conducive to reproductive ability in normal individuals This applies to both sexes

THE EXPECTANT MOTHER

In order that a baby may be well born, good hygiene is necessary during the entire nine months of the prenatal period The prenatal care which is now recognized to be essential to the welfare of both the baby and the mother includes sound nutrition as one of its most important features

It has been stated by Arnold Bennett that a baby owes nothing at all to its parents, since he has no

responsibilities and no duties, but that the parents owe everything to the baby, for their responsibility to him is complete. In commenting upon this apt statement Prof. Mary S. Rose points out[4] that "we are solemnly bound to apply all the accumulated wisdom in regard to the nutrition of the growing organism to the problem of feeding the baby."

This problem begins literally at the time of conception, or even before. The period of pregnancy is one of growth, a time when only the best food elements can be considered. Not until the last three months of pregnancy does the expectant mother really need to increase the ordinary amounts of her food, but during the entire time she must take care to secure a growth producing diet. Good nutrition is, furthermore, a factor in the prevention of miscarriages and abortions.

Milk is particularly essential in the diet of the expectant mother. She would do well to consume at least a pint of pure milk in some form every day and a quart would be none too much. She particularly needs the precious vitamin A as well as the minerals, such as the lime salts, to build bones and teeth in the fetus and to preserve and maintain her own, for if lime and other mineral salts are not provided in sufficient quantities in the diet of the expectant

[4] The Foundations of Nutrition p. 445. Macmillan, 1927.

mother, nature's demand for building the bone and teeth of the growing child is so insistent that the tissues of the mother are drawn upon for these essential elements She needs fluids for bodily elimination and these are supplied by whole milk Her protein intake can best be secured from milk

It should be remembered that the strength, calibre, and beauty of the teeth of the child depend in large measure on the nutrition of the expectant mother In addition to plenty of this mineral carrying milk, she should also bask in the sunlight as much as possible, and if that is not possible she should obtain the equivalent of sunlight by taking cod liver oil or egg yolk

As Professor Rose well says, "The diet of the pregnant woman can not safely be left to chance" Maternity is one of the most important events in the life of any woman and it is a time when the best of good health should be fostered [5]

THE NURSING MOTHER

After the baby has been born, and preferably well born, it must be fed properly The natural and best

[5] An excellent little treatise on the care of the pregnant mother is Dr R. L DeNormandie s The Expectant Mother in the National Health Series Funk & Wagnalls 1924 Another excellent reference is Carolyn C Van Blarcom s Getting Ready to be a Mother Macmillan 1929

food is that from the mother's breast Most mothers can nurse their babies and all who can should do so The quality of breast milk depends, however, on the physical condition of the mother and that in turn depends largely on her personal hygiene, with nutrition again playing a most significant rôle

As in the case of the expectant mother, pure milk is essential to the daily fare of the nursing mother, as it unquestionably has a beneficial effect on the value of breast milk and in some cases it may even help to augment the quantity Opinions differ as to whether there is really such a thing as a galactagogue, or agent for promoting the flow of milk, other than the general condition of the woman, but experience has shown that in many instances a diet high in carbohydrates is helpful in stimulating the secretion of milk Useful combinations of milk and sugar for this purpose are the malted milks, taken mixed with ordinary whole milk, or sweetened condensed milk, which has been found valuable for this purpose by clinical test [4]

Besides milk, the diet of the nursing mother should contain green vegetables and fruits, which with milk comprise the basis of the well balanced regimen Other dairy products such as butter, soft cheeses, and ice cream should also be included

[4] Macke C F, in *Medical Journal and Record*, May 4, 1928 Also editorial *The Lancet*, September 22 1928

THE YOUNG INFANT

Throughout the first year or so of life, milk is the chief food of every baby, and during the first few months of life it is almost the sole food If this milk is breast milk, so much the better, though, as has just been explained, mother's milk gains in quality when it comes from healthy mothers The breast-fed baby seems, in general, to get a better start in life than does the infant who must be fed artificially during the early months of its career Investigations made by the United States Children's Bureau have shown, for example, that there is only about one third the mortality among breast fed infants that there is in those receiving artificial feedings during the first few months of life On the other hand, artificial feeding in the last three or four months of the first year actually seems to confer a benefit, for such children have slightly lower mortality than even the breast fed [7]

Many factors enter into the problem of infant mortality and not the least of these is the intelligence, knowledge, and understanding of the mother Millions of babies have been successfully raised from birth or shortly thereafter on artificial feeding, and this success has been due largely to good medical

[7] *Causal Factors in Infant Mortality* Publication No 142, United States Children s Bureau 1925

advice, plus ability on the part of the mother to follow it, plus the availability of a clean and pure milk supply

When a mother is unable to nurse her baby for any good and sufficient reason, such as illness or an inadequate or unsuitable milk supply, dependence for the nourishment of the baby must then be placed on an outside source In the old days a wet nurse was sometimes called in, but wet nurses have rather gone out of fashion, and properly so The modern foster-mother is bottled breast milk, procured from healthy mothers and pasteurized before distribution Such milk may be obtained from child welfare agencies in large centers like New York, Detroit and Boston, and its use has saved the life of many a premature or sick baby *It is, of course, available only in limited* amounts

For the average baby modified cow's milk is the best substitute for breast milk, though goat's milk is occasionally used No other artificial food is equal to milk and such queer preparations as powdered nuts, mashed potatoes, and similar concoctions for young infants can be recommended only in certain extreme instances, if at all Cow's milk can not, however, be used for infant feeding exactly as it comes from the cow, for nature intended it primarily for calves and not babies When properly "modified," pure cow's milk becomes a satisfactory infant food, though it

must be supplemented in the diet with certain other substances

Whether a baby is breast fed or bottle fed, it is customary nowadays to give it cod liver oil or egg yolk, and orange juice or tomato juice The cod liver oil supplies vitamin D which prevents rickets, for neither mother's milk nor cow's milk contains quite enough of this important substance The orange juice or tomato juice prevents scurvy by furnishing vitamin C This vitamin is present in milk, but under certain conditions it is easily destroyed by heat and since all milk used for feeding young infants is usually heated, its content of vitamin C may be diminished Mother's milk must also be fortified with this vitamin from outside sources Child feeding specialists recommend that orange or tomato juice be given to the breast fed infant at the age of six to eight weeks, starting with from one-half to one teaspoonful a day and increasing the amount gradually until the juice of an entire orange is given every day [8]

If a baby gets plenty of sunlight, he may not need cod liver oil, but it is, nevertheless, the general routine to give cod liver oil to all children, as this substance contains not only vitamin D, the anti-

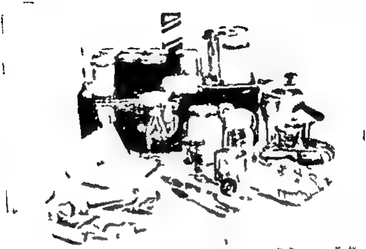
[8] McLean S, and Fales, H L Scientific Nutrition in Infancy and Early Childhood Lea and Febiger, 1925

powder such as Klim and adding 21 ounces of boiled water, with the two level teaspoonsful of cane sugar as before In purchasing a powdered milk, care should be taken to secure a powdered *whole* milk, unless a physician orders a partially or wholly skimmed milk, such as "Dryco," which is partially skimmed

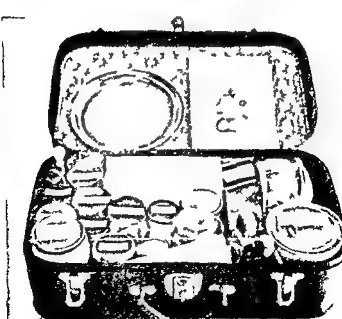
If evaporated milk is used, the easiest method is to add an equal amount of pure water to it and then consider the mixture as ordinary whole milk, and make up the formula from it Sweetened condensed milk already contains cane sugar and so is made up merely by the addition of the proper quantity of water

These canned milks are especially appropriate for traveling, whether by train, boat, or automobile A sudden change in feeding arrangements, as may occur on a trip, is not always good for a baby, but if he has been prepared properly for the journey, there is no reason why the whole family should not enjoy traveling The baby should be put on powdered or evaporated milk some time before the trip is to begin, if he is not already getting it

The equipment needed can easily be carried in a small suitcase The Division of Maternity, Infancy and Child Hygiene of the New York State Department of Health has devised a "baby's travel kitchenette," *suggesting the following equipment*, which is shown in the accompanying picture



1



2

EQUIPMENT FOR TRAVELING WITH BABIES

Suitcase	Bottle brush
Sterno	Bib
Water bottle	Nipples (4)
Nursing bottles (2)	Bottle caps (2)
Tablespoon	Jar covers (2)
Teaspoon	Measuring cup
Spatula	Funnels for bottles
Egg beater	Jar for nipples
Holder	Screw top jar or two
Towel	

THE TINY TODDLER

When the child is two years of age he is no longer a baby, but a runabout, and a runabout he remains until he goes to school This preschool period from two to six years of age is one of the most important in his whole existence, for, as Dr Arnold Gesell has well said, he may not be learning to read, but he is mastering the alphabet of life This is a time when sound nutrition continues to be of vast significance to his future welfare and happiness

At the age of two the child ought to be drinking his daily quota of milk out of a cup and he ought to be doing it with pleasure and eagerness The preschool era is the time in which to train children to eat those things which they ought to eat, and to abstain from those which are harmful Many parents seem to be confronted with the vexatious problem of getting their offspring to consume the foods which are good for them A few practical suggestions, using milk as the example, may, therefore, be of value

The first thing to remember is to commence early to inculcate proper food habits in the child. The second thing to bear in mind is to be patient and persistent. The third item is ingenuity. Make eating attractive, make it a game that is worth the playing.

Many devices may be employed to get a child to drink milk if by any chance his enthusiasm for this necessary food is waning. Special mugs or goblets, in place of the usual prosaic glasses, may cause a sudden spurt of interest in their contents. A picture pasted on the outside bottom of a glass will often induce young children to drink all of their milk in order to view this picture. Straws, macaroni sticks, or colored sippers, with tall glasses, may appeal to some children. Service in tea cups, or even doll's cups, often delights the child.

Flavors may be employed to make the glass of milk more interesting. Malted milk, either plain or chocolate is especially useful for this purpose, as it adds nourishment as well as flavor. A few drops of vanilla also make a pleasant taste, as do fruit juices. It is incidentally, not harmful to mix orange or lemon juice with milk. Egg nogs, cocoa and other drinks with a milk base may be concocted, while junkets are always valuable. Tea and coffee should not be used to flavor milk for young children and should not be given to them at all.

Children frequently like to mix their own beverages Let them prepare their own cocoa or malted milk, for then they will take pride in their handiwork and consume it with gusto Children also imitate their elders If they observe the parent drink milk, they will want to follow suit, and both the tiny toddler and the parent will profit thereby Children are hero worshippers If they know that the great or those they consider great, like Lindbergh, for instance, are drinkers of milk, they will want to do likewise

It usually does not require genius to induce children to partake of their daily quart of milk in some form, but only a little imagination, a bit of resourcefulness, and common sense and patience

THE SCHOOL CHILD

Although the United States is the most affluent and progressive nation in the world, yet there are many cases of malnutrition or undernourishment among our school children The school age, from six to eighteen or thereabouts, is an important period in life and one when health must be conserved Nutrition is especially significant for the student who is growing mentally as well as physically

In the first place the school child must be suitably nourished at home He must come to school with a good breakfast under his belt, a breakfast in which

milk and not coffee, nor tea nor wine is included Along with the milk should go fruit and toast and egg and cereal A survey of the breakfasts of nearly 700 children made in 1928 by the principal of a school at Solvay, New York, revealed that 2 per cent of the pupils had had no breakfast at all and 16 per cent had consumed coffee Only 46 per cent had been favored with milk Too many had received only a meagre meal, hardly sufficient to carry the child through the stress of a day's study

The school lunch must be sufficient, whether the child brings his own or it is supplied by the school Here again milk should be prominent Finally, the dinner at home should be well balanced and calculated to satisfy the needs of that active growing organism which is a boy or girl [19]

In many schools the authorities have adopted the admirable practice of supplying a supplementary meal of milk and crackers during the school period The children generally bring money from home to pay for the milk, though those unable to afford it may receive milk provided by some local welfare or health agency, such as the Red Cross Chapter or Anti tuberculosis Association

Seven years prior to 1928 mid morning lunches of milk were inaugurated in one of the elementary

[19] See Chapter II on the Adequate Diet.

schools at Newton, Massachusetts, and seven years later such supplemental feedings were the rule in every school in the city, with about one half of all the students the recipients of this desirable fare "These lunches," says a report on school health in Newton,[11] "have always been educational as well as nutritional, a conscious effort being made to cultivate a taste for milk as the one best food for growth"

In this city, as in most other places where milk is offered in schools, it is served in pint bottles, provided with straws The children in the lower grades drink the milk while sitting at their desks, while the teacher tells them about this wholesome product She may use it to illustrate a lesson in geography or it may serve as a vehicle for an English composition Arithmetic may even enter into this procedure, as one member of the class may be appointed as collector and banker of funds In the junior high school at Newton all children who are 10 per cent or more underweight must report to the school cafeteria for mid morning milk The result of all these efforts has been a general increase in nutrition and health

A most dramatic lesson of the value of milk was undertaken in the schools of Winston Salem, North

[11] A School Health Study of Newton Massachusetts Published as Monograph No 5 by the School Health Bureau of the Metropolitan Life Insurance Company 1929

Carolina during 1928[11] With their own white rats the children demonstrated that milk promotes growth There were several groups of these laboratory animals, all receiving a basic meal, but one group getting coffee, another candy, a third soft drinks, and the fourth milk As would be expected the milk fed rats grew large and sleek in comparison with the others who were a rather forlorn crowd The children took the lesson to heart, for they had performed it themselves, and they applied the principles they had learned

The benefits to school children from these supplemental milk feedings have been demonstrated time and time again in many countries In Scotland the most extensive feeding experiments ever undertaken with children were conducted in 1926, 1927 and 1928 under the auspices of the Scottish Board of Health, with some remarkable results In the first test, 1282 children were divided into four groups at each of seven different places in Scotland One group was given a supplemental school meal consisting of a pint of whole milk (certified or pasteurized) a day, the second got skimmed milk, the third group received biscuits of the same caloric value as the milk, while the fourth group got no supplementary feeding, as they chanced to be the controls, without which no

[11] Whittinghill E Nutrition Experiments in the Schools of Winston Salem North Carolina American Journal of Public Health September, 1928

scientific experiments can be conducted The investigation was carried on from November, 1926, to June, 1927

What were the results? "The addition of milk to the diet of children of school age during the period under review," says a report of the experiment,[13] "has been accompanied by a rate of growth as indicated by an increase in both height and weight of 20 per cent greater than that in children not receiving the extra milk," and, "This increase in the rate of *growth has been accompanied by an improvement in* the general condition of many of the children receiving milk "

As if this were not evidence enough, the experiment was resumed in the following year, with even more striking results From November, 1927, to June, 1928, there were 1425 school children in this remarkable test There were four groups as before, receiving milk, separated milk, biscuit, and nothing, respectively When measurements were taken on 1157 children it was found that those fortunate enough to get milk had gained 23 per cent more in height and 45 per cent more in weight than those who did not get milk[14] More than that, the milk fed group

[13] Orr, J B, Leighton, G, Mackenzie L Clark M L Milk Consumption and the Growth of School Children *Proceedings World s Dairy Congress*, 1928

[14] Leighton G, Clark M L Milk Consumption and the Growth of School Children (Second Report) London *Lancet*, January 5 1929

displayed the sleekness vigor, and mental alertness which characterizes the well nourished human animal

Similar, though not quite so elaborate tests, have been conducted in England and America [11] Invariably it has been shown that supplementary milk diets are of great value to growing children, and without exception the value of milk as the most *nearly perfect food has been proven*

During the adolescent period, about fourteen in boys and somewhat younger in girls, nutrition is of great significance This is the transition period from childhood to adult life, when the process of maturing is under way This is a time of character building, a time when the mental and physical changes must be safeguarded *As at other periods of life,* milk must play its rôle by contributing to safe and sane nutrition

MILK FOR ADULTS

An adult may be a grown up who has more or less ceased to grow, but he has not ceased to develop, at least intellectually (in some cases) and to a certain extent physically He still needs proper food for the repair and replacement of worn out tissues and for the promotion and maintenance of general good health Although infancy and youth are periods when nutrition is of especial significance, the attainment of

[11] Mann, H C The Value of Dairy Produce in the Diet During School Age *Proceedings World's Dairy Congress*, 1928 See also page 96 in this book.

manhood or womanhood does not permit of any abatement in the endeavor to be well nourished

Milk continues therefore, to be a correct food for adults, as well as children Although the dictionaries define a "milksop" as a weak and effeminate person, the lexicon writers take care to explain that this meaning is figurative only Chaucer wrote derogatory passages about milksops and Shakespeare speaks of a "paltry fellow,—a milksop," but a more modern connotation of the term would be "A strong, healthy, vigorous, individual, unusually alert and intelligent, these attributes due chiefly to the daily consumption of pure milk" This definition is offered to the successors of Mr Webster and the other dictionary compilers

In a study of milk consumption among 400 families in Philadelphia, conducted under the direction of the United States Department of Agriculture, it was found that most of the members of these families consume milk because they like it, rather than because they consider it of special nutritive value Fifty five per cent of the replies to the question why they used milk were, "we like it," while only 27 per cent answered that it was on account of the food value of this product The remaining 18 per cent drank milk because they were required to by their parents or physicians[14]

[14] Sherman C B Health Beliefs and Buying Habits *Practical Home Economics* March, 1929

Among the reasons given for not drinking milk, 11 per cent said "they did not need it," an indication of the belief held by a few persons that milk is in the nature of a medicine rather than a regular food. This is the attitude of the people of China, who generally look upon milk as a therapeutic agent. It is an idea which needs to be dispelled in all countries. Only 5 per cent of those who did not drink milk stated that it did not agree with them, but 13 per cent eschewed it because they considered it fattening which, of course, is not so when the entire diet is properly balanced.

Large families drink the least milk per person, according to the results of a survey of 7500 families in the District of Columbia, reported by the United States Department of Agriculture in 1929. The average consumption of milk for all the families was a little over a pint per person every day, but families composed of only two persons used 1.68 pints, while in those having four persons each imbibed only 1.24 pints, and where there were six persons the consumption went down to only 0.98 pint. Financial considerations probably help to bring about this condition, but lack of proper appreciation of the value of the most nearly perfect food probably also plays its part.

Every good text book on nutrition advocates milk

as an essential part of the diet of adults[17] As a rule, the quantity recommended is at least a pint a day, as compared with the daily quart of pure milk for all children A quart would be none too much for adults, though too much of any one food is likely to become a trifle monotonous Variety may be obtained by using milk in different ways, as in cooked foods, in dairy products, as acidophilus milk, and mixed with other beverages Before the days of prohibition, milk punch was not to be scoffed at

In the tropics, or while traveling or camping, a powdered whole milk is most useful, though the other canned milks are also valuable for these occasions These milks may likewise be kept on the kitchen shelf for emergency or regular household use

The Grecian philosopher, Aristotle, had the right idea when he wrote some 2300 years ago, "It would appear from the example of animals and of those nations who desire to create the military habit, that the diet which has the most milk in it is best suited to human beings" The virtues of milk have been extolled so thoroughly and so often in medical and popular literature that no further argument as to the desirability of milk in the adult diet is needed here The ways of using it have also been sufficiently

[17] One of the best of the general texts on nutrition is Feeding the Family (2d ed) by Mary Swartz Rose Macmillan 1928 W H Eddy s Nutrition, The Williams & Wilkins Co, 1928, is another

indicated in our various chapters, though one method of serving milk as a supplementary feeding for adults deserves special mention

In offices and factories, as in schools, a glass of milk in the middle of the morning or in the afternoon seems to exercise a beneficial effect on the workers When the fatigue of late afternoon comes on, milk removes the tired feeling and supplies sufficient energy to carry on for the remainder of the day

The vice-president of a large corporation is quoted as saying that the efficiency of his office workers increased 25 per cent by serving them a glass of milk and a cooky at 3 30 p m The large insurance companies, which have huge office personnels, and which are also vitally interested in life conservation, make it a regular practice to supply milk to their staffs for these supplementary feedings

In thousands of factories, milk is now served in a similar way, though in many places it is used only as part of the noon lunch This is, however, an advance over the days when less nutritious and helpful beverages were invariably consumed The laboring man has come to know that milk makes him feel better, even definitely lessens the hazard of industrial poisons, such as lead, mercury, etc, and aids in the reduction of doctor's bills Because milk helps to steady nerves and increases physical stamina, it is also a factor in the diminution of industrial accidents

Safety engineers, as well as physicians and dietitians, urge milk drinking by factory workers

The steady increase in the consumption of milk in the United States indicates a growing appreciation of its many dietary advantages The United States Government, through the Department of Agriculture, has stimulated many campaigns for more milk drinking, as have also state and local health authorities, agricultural, educational, and other official and voluntary agencies The United States Department of Agriculture issues a valuable circular on educational milk for health campaigns, as well as much other valuable literature on the general subject of milk[18]

The army draft in the World War revealed that many young men in the prime of life were suffering from physical defects, mostly remediable, and many of them preventable This exhaustive physical inventory of a cross section of our nation brought out, among other things, the need for an application of the principles of sound nutrition, which scientists had been formulating In 1919 the first milk-for-health campaign was conducted by the United States

[18] Hoover J M and Hall F L Educational Milk for Health Campaigns Department Circular 250 1927 United States Department of Agriculture Washington D C The United States Superintendent of Documents at Washington, D C will send without charge a list of government publications on foods and on health

Department of Agriculture, and in the same year the National Dairy Council was created by the milk industry

DAIRY ORGANIZATIONS

The task of the National Dairy Council is to help increase the consumption of milk through educational methods, with its chief emphasis on child health Its creed for children is

Use four glasses of milk each day
Eat some vegetable besides potato every day
Eat fruit every day
Drink at least four glasses of water every day
Play part of every day out of doors
Sleep many hours with the windows open
Brush teeth every day
Take a bath oftener than once a week

The National Dairy Council has headquarters at Chicago, Illinois, and in 1929 had local council units as follows

Baltimore Dairy Council
Birmingham (Ala) Dairy Council
California Dairy Council
Connecticut Dairy and Food Council (Hartford)
Detroit Dairy and Food Council
Flint (Mich) Dairy and Food Council
Iowa Dairy Council
Minnesota Dairy Council
New England Dairy Council
Ohio Valley Unit (at Cincinnati)

Philadelphia Interstate Dairy Council
Pittsburgh District Dairy Council
Twin City Unit (at St Paul)
Washington (D C) Dairy Council

From the national headquarters and from local offices much useful and attractive material on milk and dairy products may be obtained [19]

Among other dairy organizations are the Evaporated Milk Association, and the American Dry Milk Institute, each of which has headquarters in Chicago, the National Association of Ice Cream Manufacturers, located at Harrisburg, Pa, the National Cheese Institute at Milwaukee, Wis There are also a number of industrial organizations, such as the National Dairy Association, the American Dairy Federation, and the National Dairy Union, whose offices are at Washington, D C, where the government departments interested in the dairy industry are located [20]

MEDICAL USES OF MILK

In addition to its worth as a regular part of the normal diets of children and adults, normalcy in the

[19] The work and methods of the Council are outlined in a paper by its president Mr M D Munn in the *Proceedings of the World's Dairy Congress* 1928

[20] Tobey, J A The National Government and Public Health Johns Hopkins Press 1926 Also Cameron, J The Bureau of Dairy Industry Johns Hopkins Press, 1929

latter instance including periods of pregnancy and lactation, milk is also a favorite and appropriate remedy or treatment in the cases of many diseases In all fevers, for example, milk is a most satisfactory part of the diet Because of its bulk, severely ill febrile patients can seldom subsist entirely on milk and in such cases it is fortified with sugar or some other nutrient to give it a high caloric value The proper method of using milk in diseases, is, of course, a matter for the physician in charge of the case to determine [1]

A therapeutic agent known as the "milk cure" was suggested as long ago as 1866 by Karell, a Russian physician, whose system was modified somewhat and advocated by the late Dr S Weir Mitchell, who will be remembered as an author of note as well as a physician Karell's milk cure is used in cardiac, renal and hepatic dropsies, in congestion, simple hypertrophy and fatty conditions of the liver, in gastric and intestinal disorders such as chronic colitis, and chronic intestinal neuralgia, in obesity, and in functional nervous conditions in which there is malnutrition

"By using this method some very extraordinary cures or improvements may be brought about,"

[1] Tobey, J A Milk and Medical Science *American Medicine*, November, 1928.

say medical writers The method used is to put the patient to bed, keep the bowels open, and give 200 cc (about 7 ounces) of milk regularly at 8 00 a m, 12 00 m, 4 00 p m, and 8 00 p m This procedure is continued for about a week, or until the edema is diminished Then the diet is augmented by a soft-boiled egg and a slice of dry toast and is gradually increased with cereals and other articles The Mitchell method starts with 4 ounces of milk every two hours, increasing the amount and the interval to three hours

Among other conditions in which a milk diet is used by physicians are obesity, gastric disorders generally, and in pellagra and other dietary deficiency maladies Milk is useful in goiter, though its iodine content is variable, and it is one of the mainstays in the treatment of tuberculosis, the arrest and cure of which depends mainly upon rest, fresh air, and good food Milk has no special value in the cure of syphilis or cancer, except as it tends to build up general bodily resistance Its beneficial effect in the case of respiratory infections, such as colds and influenza, is well known It is not suitable for the cure of anemias, because of its rather low iron content nor is it of much, if any, value in scurvy, a disease now relatively rare

This discussion on the medical uses of milk has been inserted to show how widespread are the advan-

THE NEW YORK SUN THURSDAY, JANUAPY 17 1929

REG LAR FELLERS—Setting Down Exercises' By Gene Byrnes.

SETTING DOWN EXERCISES
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tages and uses of this most nearly perfect food It should be emphasized, however, that when diseases

occur, the sufferer does well to invoke as soon as possible the assistance of a competent physician, whose advice should be followed carefully Prevention is, of course, far better than cure, but when prevention fails, self medication, or drug store therapy should not be indulged in when suitable medical and nursing care is available, as it usually is

THE COST OF MILK

When its nutritive value is considered, milk is one of the least expensive of foods The price of whole milk varies from 12 to 20 cents a quart, depending upon the grade of milk and the locality where it is sold According to the United States Bureau of Labor Statistics, the average retail price of a quart of milk in 1927 was approximately 14 cents, or about 7 cents a pound

Compare this price of 7 cents a pound for milk with the following approximate figures for the same amount of other foods 4 cents for potatoes, 5½ for flour, 9 cents for navy beans, 9 cents for bread, 9 cents for tomatoes, 13 cents for peas, 18 cents for canned corn, 37 cents for pork chops, 37 cents for round steak, 30 cents for eggs, 31 cents for rib roast, 39 cents for lamb, 43 cents for sirloin steak, 55 cents for ham Cheese costs about as much per pound as round steak, and butter about as much as ham

The pound basis is not a strictly fair comparison,

however, as different foods have different caloric and nutritive values When we consider costs by calories, we find that 100 calories of milk cost only 2 2 cents, just half what lamb or sirloin do for the same energy yield Eggs cost 5 1 per 100 calories, round steak costs 5 7 Bread, potatoes, rice, and beans cost less than milk on a calory basis While the price of butter seems high per pound, it is actually low when the yield of calories is computed for then it comes out 1 6 cents per 100 calories, or even less than whole milk Cheese is correspondingly low, 1 9 cents per 100 calories

This is not the whole story, however, for if we could put a price on vitamin content, the value of milk would be increased One investigator has computed that a quart of milk, selling for perhaps 14 cents is actually worth 21 cents when the relative value of its fat, protein, sugar, and some of its vitamins, as compared with other food fats, proteins and sugars, is taken into account [22]

The best rule for the household desiring to make the most economical and effective use of its expenditures for food is that suggested by Professor H C Sherman, who advises [23]

[22] Rice F E Value of Milk and the Cost of Bottled Milk *North Carolina Health Bulletin February, 1926*

[23] Sherman H. C. Chemistry of Food and Nutrition (3d ed) Macmillan 1926

"(1) At least as much should be spent for milk (including cream and cheese if used) as for meats poultry, and fish and

(2) At least as much should be spent for fruits and vegetables as for meats, poultry and fish"

Another rule which was recommended by the Food Administration for the family food budget is

"Divide your money into fifths

One fifth, more or less for vegetables and fruit,
One fifth or more for milk and cheese
One fifth or less for meats fish and eggs,
One fifth or more for bread and cereals
One fifth or less for fats, sugar, and other groceries and food adjuncts

Evaporated milk is the cheapest form of milk now on the market, as it costs only about 10 cents a can for a 16-ounce can, the equivalent when diluted of a quart of whole milk In some chain stores this milk may even be obtained for as little as 3 cans for 25 cents Sweetened condensed milk costs on the average about 18 cents for the best grade in 15 ounce cans, while a slightly lower grade in a 14 ounce can averages 14 cents

Powdered whole milk sells at retail for 90 cents a pound, which when diluted makes a gallon of whole milk This gives a price of about 22 cents a quart In 5 pound tins, it is only about 72 cents a pound, or 18 cents for a quart of whole milk, produced from this powder A pound of powdered skim milk will cost

around 55 cents a pound. All of these are prices, of course, subject to considerable variation, due to many local marketing conditions.

When all is said and done, however, milk is cheap in any form. At least one fourth of the total daily calories for the whole family should come from milk and this causes no strain on the family budget. The investment is one which yields rich returns, for health is the best of all investments.

CHAPTER VII

USEFUL MILK PRODUCTS[1]

Among the many attributes of milk is the ease with which it may be changed into useful products This convertibility of milk in the hands of the manufacturer results in various foods, all of which inherit many of the excellent characteristics of their fluid ancestor Each of them has a definite place *in the scheme of human nutrition and each should* have a popular place in the household

The use of milk products is almost as ancient as is that of milk itself Butter and cheese are both mentioned in the Bible, for in GENESIS (18 8) we are told that Abraham took butter and milk and set it before his guests and they did eat, while in the first book of SAMUEL it is narrated that Jesse commanded David to "bring these ten cheeses unto the captain of their thousand and look how thy brethren fare " Numerous other references to milk products are to be found in the Bible and in other ancient writings

The products of milk are made by separating one or more of its constituents from the whole and

[1] The largest portion of this chapter appeared in 1928 and 1929 as a number of articles in *Hygeia* the health magazine of the American Medical Association

utilizing the part removed or the residue, either as they are or after further processing Thus butter is made by separating fat from milk in a certain way, what remains is called buttermilk Cheese is the solid part of milk after it has undergone a rather complicated process following its removal from the milk Powdered milk is milk minus nearly all the water which is a normal constituent of it In some products, as in the case of ice cream, malted milk, and sweetened condensed milk, substances other than milk are added

In separating one or more components from milk, the division is seldom complete and as a consequence, the various milk products usually contain all of the constituents of milk, though some of them may be present in small and even in insignificant quantities The composition of the different products may also vary greatly There are, for example, literally hundreds of varieties of cheese, displaying many different chemical combinations All of these diverse milk products do, however, possess some common characteristics and the function of each in human nutrition is now well understood A brief description of each, with special reference to its food value, may therefore be of interest to the reader who should possess knowledge regarding each phase of the most nearly perfect food and the members of its immediate family

CREAM

Cream is that part of milk which contains most of its fat As sold in our modern marts of trade, cream is a milk product in which the amount of fat has been increased, from five to a dozen times, and the other milk solids and the water reduced The cost to the consumer is likewise increased, though not in such proportions

Though the percentage of fat in cream may vary from 8 to 70, there are three well known grades, light cream having approximately 20 per cent fat, heavy cream with 30 per cent fat, and whipping cream, which has about 40 per cent fat Milk, it will be remembered, contains an average of 3 7 per cent butter fat, though the amount ranges from 3 per cent (or even less) to 6 per cent (or even more), depending on the breed of cattle and other factors

When cream is whipped, air is beaten into it, with the result that a fairly rigid foam is formed The whipping of cream is, in fact, a partial churning and if continued too far produces butter The process of whipping exerts no deleterious effect upon the nutritive value of cream

From the standpoint of nutrition, cream obviously has all the advantages of milk It is an especially good source of vitamin A, which is so abundant in butter fat, and it contains the other vitamins found

in milk The protein is only slightly less than in milk and the minerals are plentiful Cream, being essentially fat, is, of course, somewhat fattening if used in considerable amounts In ordinary quantities, it is a valuable adjunct to the well balanced diet

BUTTER

An Aryan horseman galloped across an Asian plain one day thousands of years ago and discovered butter This important event was one of those fortunate accidents which have contributed so much to the progress of man It happened like this When he started, the horseman had with him a goatskin filled with sour milk The journey was long and rough, the day was moderately hot When he reached his destination and dismounted, seeking to appease hunger and thirst, the Aryan was bewildered to find something other than milk in his goatskin

With some trepidation, for the acts of the gods were often mysterious in those days, he tasted the yellow mass Then he tasted it again, for it was good He told other herdsmen, who probably scoffed at him as a fool, as is customary when new benefits are announced, but eventually they too tried the product of the galloping churn Soon the tribe was making butter, hanging up the goatskins

F I P Albrecht

THE MILK WAGON OF NAPLES

Early in the morning the goats click-clack their hard little hoofs up and down the narrow lanes and flights of steps that in parts of Naples serve for streets, bringing Naples milk fresh and unadulterated for its morning meal. National Geographic Society

filled with sour milk and beating them with sticks or shaking them until the golden mass appeared That is the way butter is made to this day in some parts of the world

Ever since that memorable occasion, butter has been one of the most important foods of man The ancient Hindoos got the recipe from the Aryans and made butter two thousand years before Christ, as did also the Hebrews and Egyptians of old The Greeks had butter at least five centuries before Christ and it was popular in Roman times Often butter was used externally as a medicine for man and beast According to one writer,[2] historians have told of butter as a remedy for wounded elephants and Galen has mentioned it as the basis of the bath among ancient peoples in cold regions Butter seems to have been popular as a cosmetic as well as a food History has almost repeated itself in this case, for today one of the best cosmetics is realized to be a well balanced diet, in which good butter has a prominent part

In the early Christian era and well on into the middle ages, butter was reserved more or less as a food for the wealthy In the rich Scandinavian dairy regions, it was produced in considerable quantities

[2] Hayward H Facts Concerning the History etc, of Butter United States Department of Agriculture B A I Circ No 5 1904

for general consumption and even for export It is related[3] that in the twelfth century German traders sent vessels to Norway to exchange wine and dried fish for butter, but a wise king who considered the products of the cow more beneficial to his people than the juice of the grape put a stop to the traffic In the nineteenth century the Danes were pre eminent as butter makers, though they often had to import dairymaids educated in the Netherlands

It was a Swedish engineer, Gustav De Laval, who gave the greatest impetus to butter making when in 1878 he perfected the centrifugal separator, a machine originally invented by a German, Wilhelm Le Feldt The De Laval separator was introduced into the United States in 1885, and when in 1890 Dr S M Babcock invented a method for the determination of the butter fat in milk, a procedure now universally known as the Babcock test, the necessary equipment was at last available for tremendous progress in this important industry, a progress which soon occurred In 1849 the consumption of butter per person per year in this country was about 14 pounds, but in 1899 it was nearly 20 pounds Today, when about one quarter of all the milk produced in the United States is used for making creamery butter, and another 10 per

[3] Ibid

cent for farm butter, the annual per capita consumption is about 18 pounds

The great value of butter as a nutriment lies in the fact that, except for cod liver oil and egg yolk, it is the most abundant source of vitamin A This vitamin has been demonstrated to be not only essential to growth, but to be a contributor to the general health and well being of the individual Its presence in the diet promotes a favorable resistance to disease, particularly the respiratory infections, according to Prof H C Sherman, and it has also been shown to exert a beneficial influence on fertility and reproduction The vitamin may be stored in the body as an efficient reserve for future needs

Butter will obviously do all that vitamin A will do, for it is mostly the fat part of milk The average composition of butter is 83 per cent fat, 13 per cent water, 1 per cent protein, and 3 per cent salt, though the federal standard is a minimum of 80 per cent fat and in most states the maximum moisture content is set at 16 per cent A pound of butter supplies 3410 calories, sufficient for a laborer working twenty four hours, though of course a workman may and does get his calories from many foods, with only a fraction of them from butter It is one of the most digestible of foods, the coefficient of digestibility having been put at about 98 per cent Because of these many virtues, most scientific and

medical authorities are agreed that there is no dietetic substitute for good butter

In the modern manufacture of butter a number of steps are involved These include the procuring of clean milk, the separation and preparation of the cream, the churning, the washing and working of the butter, and the packing of the finished product In every step of the whole procedure scrupulous cleanliness with respect to utensils and methods is absolutely necessary and today is, fortunately, the general rule

The first requisite of good butter is good milk[4] It must be clean and safe milk, free from dirt and low in bacteria, which means that it must have come from clean, healthy cattle, and be milked into sterile utensils by healthy persons using sanitary methods In some places butter is made direct from whole milk, but it is better to separate the cream for the purpose In either case the milk must be kept clean and free from disagreeable flavors and odors

Cream is now usually separated by means of one of the mechanical separators, though the separation formerly was often accomplished by the old fashioned and now obsolete gravity method, in

[4] White William Making Butter on the Farm. *Farmers Bulletin* No 876 1924 United States Department of Agriculture Washington, D C.

which the milk was placed in a pan set in cold water Invariably some of the cream failed to separate in this process, which was also much slower and frequently much less sanitary than in the case of the modern centrifugal separator The separator must, of course, be carefully cleansed, scrubbed, and sterilized after each use and it should be properly run The present day tendency is to deliver cream to a creamery for separation by a power driven machine, though a considerable amount still undergoes hand separation on the farm

After separation the cream is stirred and cooled to a temperature of below 60°F, or preferably less, the constant up and down stirring helping to produce a uniform temperature throughout the cream mass It is then allowed to stand in order to "ripen" Properly soured cream is usually employed in butter making, though it is possible to manufacture butter from sweet cream The growth of the lactic acid bacteria which bring about the souring of the cream also impart a distinctive flavor to the butter, popular among the users of that commodity If the original milk was not clean, other forms of bacteria may grow and cause undesirable flavors In many cases the cream is aided in souring by the addition of a so called "starter," a pure culture of lactic acid producing bacilli These bacteria are, of course, among the many types of

organisms beneficial and not harmful to man In commercial butter making all cream is now pasteurized before churning

When ripening has been properly completed, the next step is the churning The churn is one of the most ancient of the implements used by man and has evolved from the goatskin of our Aryan ancestor to the great machines used in the modern creameries A German author, Benno Martiny, wrote in 1895 a most interesting account of the early use and development of the churn, but unfortunately there *is as yet no English translation of his engrossing treatise*

The churn is filled about two thirds full of strained cream at the proper temperature, which varies from 52° to 60°F in the summer and from 58° to 62°F in the winter Butter has a high natural color in the spring and summer, but at other times of the year may be only faintly yellow, so that a few drops of annatto, a harmless coloring substance, the use of which is sanctioned by federal food authorities, is sometimes added to maintain uniform color throughout the year This practice is, however, going out of style, as the public now accepts a medium colored butter at all times, and many of the commercial companies do not color their butter at any time nowadays The cream is next churned at the proper speed for half an hour

or more The completion of churning is made evident by a distinctly different noise in the churn, a sound which the expert readily senses, and also by the appearance of a thick mass on the glass of the churn The time to stop is when the butter granules resemble grains of wheat

The churning completed, the buttermilk is drawn off and the remaining butter is washed twice with pure water of about the same temperature as the buttermilk After this water has been drained away, the butter, still in a granular condition, is removed from the churn, is weighed, and the correct proportion of salt is added The butter is then "worked," or pressed into a solid mass by means of appropriate devices This working must be carefully and exactly performed in order to secure the proper texture All that now remains is to pack the butter, distribute it, and consume it

With the packing and distribution we are not concerned here, but something should be said about the eating Because of its unusual nutritive value, butter should be generously used in every household As a spread for bread it has no equal, at least from the standpoint of nutrition, and none of the imitations have a food value equivalent to that of good butter Those who eat plenty of butter may indeed realize the words of the prophet Isaiah when he said (7 15) "Butter and honey shall he

eat, that he may know to refuse the evil, and choose the good"

CHEESE

Although cheese is distinguished as one of the most ancient and honorable of milk products, it is now frequently regarded by superficial connoisseurs merely as a relish The function of cheese is, however, much greater than as a condiment, for it consists mainly of the solid part of milk, except the lactose, and it is therefore a concentrated food rich in protein, fat, and minerals As such a food cheese deserves a place in the meal and not at the end of it

Cheese was probably discovered at about the same time and in about the same way as butter, though the ancient Greeks always claimed that such a delicacy must have been invented by one of the gods What undoubtedly happened was that an Aryan gentleman started on a journey one day several thousand years ago, carrying on his person a detached sheep's stomach full of milk When he reached wherever he was going, at the end of a hot day, and opened the ruminant container, he found a thick curd where the milk had been This was the first cheese, though it was probably a long time after that before the Aryan also discovered that something in an imperfectly dried sheep's or calf's stomach curdled milk That something was rennet

So popular and important did cheese then become that these herdsmen of old Asia eventually measured their wealth in its terms. They imparted the secret of cheese making to other peoples and in future ages it was well considered among the Assyrians, Egyptians, and Hebrews. Legend has it that Queen Semiramis of Nineveh was nourished as a child on cheese brought to her by birds who had stolen it from the shepherds.

The ancient Hebrews and later the Romans used cheese as an army ration. In Caesar's time, this product was a delicacy in Rome and it is mentioned by Pliny and other writers, some of whom went into details about the making of cheese. In medieval England immense cheeses were prepared for christening ceremonies and the child was passed through the hole in one of these so called "groaning cheeses" after being baptized. The participants in the festivities then ate the cheese and unquestionably derived more benefit from the proceedings than did the baby.

More than four hundred different cheeses are known today, though in the galaxy of names, only about twenty actual varieties are found. Many cheeses have received their appellations from the places where they were first made or developed. Thus there are the Edam of Holland, the Neufchâtel and Emmenthal of Switzerland, the Cheddar

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whey consists of water, milk sugar, albumin, and some salts Next, this reduced curd is salted and compressed into a characteristic form The product is now known as "green cheese" and is seldom used for eating The final step in the process is the ripening, which may require from a few weeks to several months, depending on the variety Some cheeses are pasteurized before they are placed on the market

In order to ripen a cheese it is kept under appropriate conditions of temperature and moisture so that bacteria and other microorganisms can work upon it These bacteria are not the harmful kind that cause disease but are included in the immense family of helpful germs Many different types of microorganisms are employed, among the most important being several members of the lactic acid group of bacteria These particular bacilli are valuable inhabitants of the human system, because they crowd out the putrefying microbes, such as the *B coli*, which help to cause constipation and intestinal toxemias Acidophilus milk, described later in this chapter, is today a favorite beverage for a similar purpose

The microbes that work on cheese during the ripening process bring about certain chemical changes They convert the original milk proteins into more digestible and palatable compounds, pro-

of England, the Parmesan and Gorgonzola of Italy, the fragrant Limburger of Belgium, and the Camembert, Brie and Roquefort of France, to mention only a few The French make the greatest variety of cheeses, with Germany second The American specialties are cream, pineapple, brick, and American Cheddar cheeses Switzerland, France, and Holland are now the leading producers of cheese

The manufacture of cheese involves a number of complex chemical processes with almost as many variations here as in the number of different kinds Not only is cow's milk used, but cheese is manufactured from goat's, sheep's, buffalo's, llama's, zebra's, and reindeer's milk Genuine Roquefort, for instance, comes from sheep's milk, though a satisfactory type is now made from cow's milk The cheeses themselves are scientifically classified as soft, medium, or hard, though they are sometimes yclept from their source, such as cream whole-milk skim milk and whey

Four steps are, in general, necessary in the manufacture of cheese First, the milk casein is coagulated into a mass of curd This is accomplished by a chemical substance called an enzyme, an appropriate kind of which occurs in rennet In the second step, the curd is gradually heated and manipulated, so that a sufficient amount of whey can be separated from the fat and casein The

whey consists of water, milk sugar, albumin, and some salts Next, this reduced curd is salted and compressed into a characteristic form The product is now known as "green cheese" and is seldom used for eating The final step in the process is the ripening, which may require from a few weeks to several months, depending on the variety Some cheeses are pasteurized before they are placed on the market

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The microbes that work on cheese during the ripening process bring about certain chemical changes They convert the original milk proteins into more digestible and palatable compounds, pro-

ducing characteristic flavors and giving piquant tastes to the products. Even in the days of the ancient Romans, long before bacteria were discovered or even heard of, cheese was ripened in this way, though the reason for the results was unknown. Thus, the real Roquefort cheese has been ripened from time immemorial in the cool grottoes of the locality. It is said that Roquefort cheese was discovered some eight hundred years ago when a French peasant left his lunch of bread and butter and native cheese in one of these caves. Strange to relate, he completely forgot about his food and left it there for several weeks. When he did return for it, his cheese had so improved in flavor that cheeses have been ripened in those caves ever since.

The ripening process is started by placing between the layers of cheese curd crumbs of an old moldy bread, especially prepared from wheat and barley and properly aged. Some of the so called "strong" varieties of cheese may contain putrefactive bacteria or molds, besides members of the lactic acid group.

Since cheese making is such a complex process, the composition of cheese varies somewhat. Table 10 gives approximate compositions of some of the well known types.

One great advantage of cheese is that it is practically all food, with no waste. It is called a concentrated food because 95 per cent of the protein

and 90 per cent of the energy value are available For this reason and others it is an economical article of diet, and one of our leading authorities on nutrition, Prof Henry C Sherman of Columbia University, is quoted as recommending that the Ameri-

TABLE 10

APPROXIMATE COMPOSITION OF SOME WELL KNOWN TYPES OF CHEESES*

NAME	COMPOSITION (PERCENTAGES)						
	Protein	Casein	Fat	Ash	Salt	Lactic acid	Water
Parmesan	43 3		19 1	6 3		2 4	32 2
Swiss	26–30		30–34	3–5	1–1 4		30–34
American Cheddar		23 4	33 4	5 9			37 3
Roquefort	21 4		32 3	6 1	4 1		38 7
Camembert	19 7		27 3				47 9
Brick	21 0		30 7	3 0			42 5
Neufchâtel	18–21		23–28	0 5–1 25			50–55
Cream	13–16		43–48	0 5–1 25			38–43
Cottage	13–21		0 4–1 9	0 8–2 5			71–80

* *From Fundamentals of Dairy Science* pp 36 37, 38 Chemical Catalog Co 1928

can people should spend three times as much as they now do on cheese and such milk products

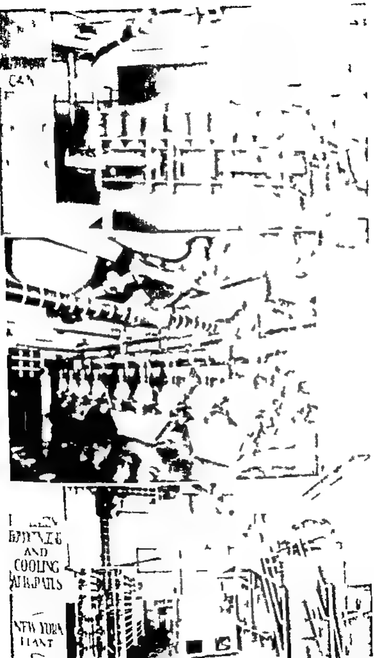
While cheese digests slowly, it is by no means an *indigestible food, as many people seem to think* The ease of digestibility depends somewhat on the

that Catherine de Medici brought water ices to France from Italy in 1550[1]

Recipes for cream ices have been found in old English cook books dating from 1769 and 1776 On a hot day in August, 1774, the chef of the Duc de Chartres earned his master's undying gratitude by serving at his mansion in Paris a delectable cream ice with the ducal coat of arms sculptured upon it Louis XIV, who enjoyed all things magnificent, is also reported to have had ice cream on his sumptuous table

In the United States, ice cream was manufactured in Revolutionary days, for on May 12, 1777, there appeared in the New York *Gazette and Weekly Mercury* an advertisement to the effect that, "Ice cream may be had almost any day," at No 517 Hanover Square in New York City Another advertisement in the *Post Boy* for June 8, 1786, stated that ice cream was obtainable daily from "your humble servant," Joseph Crowe, at his City Tavern in New York Dolly Madison served ice cream at a White House dinner in 1809, though Mrs Alexander Hamilton is said to have been the first hostess in the national capital to offer this delicacy to her guests

[1] Turnblow G D and Raffeto, L A Ice Cream John Wiley & Sons 1928


AND
COOLING

One of the early venders of ice cream in America was a negro, Andrew Jackson, who had worked at the White House in a culinary capacity, and who set up in Philadelphia in 1832 as a dispenser of cream ices The real father of the business in America, however, was Jacob Fussell of Baltimore, who started there in 1851 and so prospered in the sale of the frozen luxury that he opened plants in Boston in 1862 and in New York in 1864 The New York branch of this business is still conducted by the well known J M Horton Company In 1909 the total production of ice cream in this country was about 80,000,000 gallons, whereas in 1926 it was about 325,000,000 gallons

In the manufacture of ice cream, only the best grade of milk and cream can and should be used The milk must be clean and safe, as this term is defined in a previous chapter,[a] and it must come from healthy cattle, be low in bacteria, and be free from odors and undesirable flavors Other products used in the making of ice cream must likewise be of good quality

The first step in commercial ice cream making is to prepare what is known as the "mix" There are, of course, innumerable recipes and formulas for ice cream mixes and their proper blending is some

[a] See p 110

times a complicated procedure The various milk products are first placed in the correct proportion in a large container, often a mechanical mixer Sugar is next stirred in and then a stabilizer, frequently gelatine or gum tragacanth, is added At this point the mix may be homogenized or emulsified, after which coloring and flavoring materials are added The mix is nowadays usually pasteurized in order to reduce bacteria and destroy any dangerous types which might be present

Freezing is the next step in the process and it is one which must be carefully controlled in order that a mellow body and smooth texture will result Numerous devices for ice cream refrigeration are now manufactured and there are so many different ones that it is useless to attempt to describe any of them

The ice cream coming from the freezer is in a semi-solid condition, so that further hardening is necessary as the next step The ice cream is usually removed from the freezer and placed in special hardening receptacles, which are stored for about twelve hours in refrigerator rooms The ice cream is finally cut, molded, and packed for shipment to the retailer It is then ready for human consumption

As a food ice cream has much to be said in its favor Because of its high carbohydrate content and excellent value as a fuel, it has been called

"frozen heat," a picturesque if paradoxical term A good grade of ice cream will produce anywher from 700 to 1200 calories per pound, depending o the substances it contains, while an ordinary dish o ice cream will have from 200 to 250 calories, and th usual ice cream cone about 80 A distinction shoul be made between the modern "water ice" or sherbet and ice cream, since the former does not have mil or cream and is simply a frozen mixture of wate and flavoring material

On account of its coldness ice cream should b eaten slowly, and the best time to partake of it i with a meal It should not be too hard, as th flavor and palatability are improved when ice crear is rather soft When properly prepared and cor rectly consumed, ice cream should have no delete rious effect on the normal digestive apparatus I is a good food for adults and children, except fo young babies, whose diet should preferably be unde the supervision of a competent physician, and fo diabetics, who are generally forbidden to use an sweets Ice cream is one of the excellent mean of helping the child to get the quart of milk whicl ought to be in his daily regimen It should b looked upon as a food and not merely as luxury

THE FERMENTED MILKS

Artificially soured milks have been popular as beverages for many hundreds of years As long ago as the thirteenth century, that most celebrated of world travellers, Marco Polo, described the kumys, or koumis, the soured mare's milk made by the Tartars Of late years, buttermilk, acidophilus milk, and other fermented milks have been gaining in favor in our own country, while acid and effer vescent milks continue to be consumed with much gusto in various parts of the Old World

A fermented milk, as the term is now generally used, is simply a milk made sour or acid by the action of bacteria or other organisms on the milk sugar or lactose The microbes which usually bring about this desirable change are members of the lactic acid group of bacilli, though in some instances yeasts and organisms other than bacteria may be employed *Lactic acid bacilli are not only harmless to man, but they are among the many microbes which are actually helpful to humans* Fortunately, not all germs are bad, but only those which cause specific communicable diseases

Buttermilk

Perhaps the best known of the fermented milks is buttermilk Genuine buttermilk is the liquid

remaining after the fat has been removed from the milk by churning Since sour cream is usually employed in modern butter making,[7] the remaining buttermilk is slightly acid, a condition which results in breaking up the curd and thus making it more digestible If, on the other hand, sweet cream is used, the resulting buttermilk is really nothing more than a skim milk

Much of the commercial buttermilk is made not from the residue after the manufacture of butter, but by taking skim milk, pasteurizing it, then artificially souring it by adding the proper bacteria, and finally stirring or churning it somewhat to disperse the curd particles Such buttermilk, is, of course, just as nutritious as that derived directly from the churn

There is said to be an ancient Hindoo proverb that "a man may live without bread, without buttermilk he dies" In the light of modern knowledge this axiom seems rather extravagant Buttermilk is a food product of value, especially because of its easy digestibility and its favorable content of beneficial bacteria It is, however, not equal to pure whole milk as a nutriment, for whole milk contains the precious fat which is lacking in buttermilk, and this fat is rich in the vitamins, particu-

[7] See p 176

larly vitamin A, essential to growth and general good health.

Buttermilk contains on the average 91 per cent water, as against about 87 per cent in whole milk. There is only 0.5 per cent of fat, but protein, the tissue builder, is fairly abundant, amounting to 3.5 per cent. There is from 3.5 to 4.5 per cent of lactose, or milk sugar, and the ash or minerals, such as the lime salts which build bones and teeth, are present to the extent of from 0.65 to 0.73 per cent. Buttermilk is an excellent beverage, but the buttermilk enthusiast should also drink at least one glass of whole milk a day in order to aid in optimum nutrition.

Acidophilus Milk

The intestinal tract of man always harbors a great number and variety of microorganisms or germs. This collection of microbes, scientifically known as the "bacterial flora" of the intestine, differs in each individual, for its content is controlled to a considerable degree by the nature of the diet. Persons who drink plenty of pure milk tend to have more favorable bacterial flora in their intestines than do those who never or seldom imbibe this necessary fluid.

The young infant has in his intestine a preponderance of the favorable bacilli known as *L*

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times a complicated procedure The various milk products are first placed in the correct proportion in a large container, often a mechanical mixer Sugar is next stirred in and then a stabilizer, frequently gelatine or gum tragacanth, is added A this point the mix may be homogenized or emulsified, after which coloring and flavoring materials are added The mix is nowadays usually pasteurized in order to reduce bacteria and destroy any dangerous types which might be present

Freezing is the next step in the process and it is one which must be carefully controlled in order that a mellow body and smooth texture will result Numerous devices for ice cream refrigeration are now manufactured and there are so many different ones that it is useless to attempt to describe any of them

The ice cream coming from the freezer is in a semi solid condition, so that further hardening is necessary as the next step The ice cream is usually removed from the freezer and placed in special hardening receptacles, which are stored for about twelve hours in refrigerator rooms The ice cream is finally cut molded, and packed for shipment to the retailer It is then ready for human consumption

As a food ice cream has much to be said in its favor Because of its high carbohydrate content and excellent value as a fuel, it has been called

"frozen heat," a picturesque if paradoxical term A good grade of ice cream will produce anywhere from 700 to 1200 calories per pound, depending on the substances it contains, while an ordinary dish of ice cream will have from 200 to 250 calories, and the usual ice cream cone about 80 A distinction should be made between the modern "water ice" or sherbet, and ice cream, since the former does not have milk or cream and is simply a frozen mixture of water and flavoring material

On account of its coldness ice cream should be eaten slowly, and the best time to partake of it is with a meal It should not be too hard, as the flavor and palatability are improved when ice cream is rather soft When properly prepared and correctly consumed, ice cream should have no deleterious effect on the normal digestive apparatus It is a good food for adults and children, except for young babies, whose diet should preferably be under the supervision of a competent physician, and for diabetics, who are generally forbidden to use any sweets Ice cream is one of the excellent means of helping the child to get the quart of milk which ought to be in his daily regimen It should be looked upon as a food and not merely as a luxury

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THE FERMENTED MILKS

Artificially soured milks have been popular as beverages for many hundreds of years. As long ago as the thirteenth century, that most celebrated of world travellers, Marco Polo, described the kumys, or koumis, the soured mare's milk made by the Tartars. Of late years, buttermilk, acidophilus milk, and other fermented milks have been gaining in favor in our own country, while acid and effervescent milks continue to be consumed with much gusto in various parts of the Old World.

A fermented milk, as the term is now generally used, is simply a milk made sour or acid by the action of bacteria or other organisms on the milk sugar or lactose. The microbes which usually bring about this desirable change are members of the lactic acid group of bacilli, though in some instances yeasts and organisms other than bacteria may be employed. Lactic acid bacilli are not only harmless to man, but they are among the many microbes which are actually helpful to humans. Fortunately, not all germs are bad, but only those which cause specific communicable diseases.

Buttermilk

Perhaps the best known of the fermented milks is buttermilk. Genuine buttermilk is the liquid

remaining after the fat has been removed from the milk by churning Since sour cream is usually employed in modern butter making,[7] the remaining buttermilk is slightly acid, a condition which results in breaking up the curd and thus making it more digestible If, on the other hand, sweet cream is used, the resulting buttermilk is really nothing more than a skim milk

Much of the commercial buttermilk is made not from the residue after the manufacture of butter, but by taking skim milk, pasteurizing it, then artificially souring it by adding the proper bacteria, and finally stirring or churning it somewhat to disperse the curd particles Such buttermilk, is, of course, just as nutritious as that derived directly from the churn

There is said to be an ancient Hindoo proverb that "a man may live without bread, without buttermilk he dies" In the light of modern knowledge this axiom seems rather extravagant Buttermilk is a food product of value, especially because of its easy digestibility and its favorable content of beneficial bacteria It is, however, not equal to pure whole milk as a nutriment, for whole milk contains the precious fat which is lacking in buttermilk, and this fat is rich in the vitamins, particu-

[7] See p 176

larly vitamin A, essential to growth and general good health

Buttermilk contains on the average 91 per cent water, as against about 87 per cent in whole milk There is only 0 5 per cent of fat, but protein, the tissue builder, is fairly abundant, amounting to 3.5 per cent There is from 3 5 to 4 5 per cent of lac tose, or milk sugar, and the ash or minerals, such as the lime salts which build bones and teeth, are present to the extent of from 0 65 to 0 73 per cent Buttermilk is an excellent beverage, but the butter milk enthusiast should also drink at least one glass of whole milk a day in order to aid in optimum nutrition

Acidophilus Milk

The intestinal tract of man always harbors a great number and variety of microorganisms or germs This collection of microbes, scientifically known as the "bacterial flora" of the intestine, differs in each individual, for its content is controlled to a considerable degree by the nature of the diet Persons who drink plenty of pure milk tend to have more favorable bacterial flora in their intestines than do those who never or seldom imbibe this necessary fluid

The young infant has in his intestine a pre ponderance of the favorable bacilli known as *L*

acidophilus, but as the child grows older, these are usually displaced by other less advantageous, though not necessarily dangerous, types. The intestine of the average adult usually abounds in the so called proteolytic, or protein digesting, and other putrefactive bacteria. He would be better off if his intestinal system still contained mostly the acidophilus bacilli of early infancy.

In order to help "change the intestinal flora" there are now manufactured and sold the acidophilus milks. These are whole or slightly skimmed milks which have been inoculated with the *L. acidophilus*, a lactic acid producing bacillus. When this milk is ingested in sufficient quantities, the favorable acidophilus bacilli are implanted in the intestinal tract, driving out the putrefactive and other types. Acidophilus milk has been found to be useful in cases of constipation, colitis, diarrhea, and digestive disturbances, as well as by contributing to the maintenance of general health.

Milk is the best carrier of the *L. acidophilus*, for the germ thrives in the presence of the lactose, or milk sugar, which is naturally present in milk. Pure lactose powder may, in fact, be taken with acidophilus milk, as this proximity aids in promoting the fermentation in the lower intestine which makes an unpleasant environment for the less desirable bacteria. To be truly effective, acidophilus milk

must be fresh and contain an enormous number of the bacilli [8]

A score or so of years ago Dr Eli Metchnikoff thought that he had discovered the bacillus for long life in the so called Bulgarian bacillus, which had been used for ages in the Balkans to sour milk For many years thereafter Bulgarian Yoghurt was a popular beverage, but in 1914, Drs L F Rettger and H A Cheplin of Yale University began experiments which eventually proved that the *L bulgaricus* could not be implanted in the intestinal tract at all These investigators did show, however, that it was the closely related organism, the *L acidophilus* which was of real value in this connection

Acidophilus milk is now generally sold in bottles by leading milk companies and it may be obtained in most drug stores, at soda fountains, and in well equipped restaurants It has, in general, the favorable properties of whole milk, the most nearly perfect of the foods of man, as well as the added advantage of those highly beneficial bacteria Good acidophilus milk can be most highly recommended as a desirable part of the normal diet, as well as in such special cases as may be suggested by the physician

[8] Kopeloff N Cohen P, and Berman P Commercial Acidophilus Products. *Journal of the American Medical Association* October 20 1928 See also Kopeloff N Lactobacillus Acidophilus. The Williams & Wilkins Co, 1926

Some Other Fermented Milks

The number of fermented milks which have been made for centuries in Europe, Asia, and the Far East is legion The Balkans, Russia, and Turkey have long been famous for such products as the kefir, of the Cossacks, the kumiss of Russia and Mongolia, the yoghurt of Bulgaria and Turkey, the mazum or matzoon of Armenia In Egypt there is lebin, in India dadhi Even the Scandinavian countries have a fermented milk called "taetle" An excellent description of these products and, in fact, of all fermented milks is given in Department Bulletin No 319 of the United States Department of Agriculture, which was revised in November, 1928

Kefir, also called "kepi," "hippe," and by various other names, all meaning "pleasant" or "agreeable" taste, is made from the milk of sheep and goats as well as cows The method of manufacture is rather primitive, as it consists merely of filling a somewhat dirty goatskin with milk, adding kefir grains, and hanging it in a doorway where each passerby may give it a kick As the kefir milk is removed from time to time, fresh milk is added to the goatskin and the process continues indefinitely, or until so much foreign contamination has gotten in that no more good results are possible Kefir milk contains alcohol and is intoxicating Imitations of it,

somewhat more sanitary, have been made in our country

The kumiss (kumys, koumis) made from mare's milk in Russia and Asia is manufactured by methods as unclean as are the native procedures with kefir The fermentation is begun by adding decayed matter to milk and then is continued by withdrawing the finished kumiss from the dirty vessels and adding more milk Yeasts and bacteria both play a part in the fermentation and the product is also alcoholic The kumiss occasionally sold in this country is, of course, a much more carefully supervised product

Yoghurt is a fermented milk having no alcoholic content, as its properties depend chiefly upon the action upon the milk of the group of so called Bulgarian bacilli In the Balkans the method is to use a portion of the previously fermented milk to start a new batch Bulgarian yoghurt is made in this country, but is less popular today than formerly, as it has been displaced largely by acidophilus milk

Of all the fermented milks, acidophilus is recognized today to be the most valuable, though buttermilk also has advantages Both of these products are worthy offspring of milk and both deserve the popularity they are now enjoying

OTHER MILK PRODUCTS

In addition to the important milk products, such as cream, butter, cheese, ice cream, buttermilk and acidophilus milk, to which space has properly been devoted in this chapter, there are a number of other valuable products of the most nearly perfect food Of special significance are the concentrated forms of milk, including the condensed, evaporated, powdered and malted, which are described at some length in the next chapter Other milk products include skim milk, whey in various forms, and casein

Skim milk is the liquid remaining after the fat has been removed from whole milk It contains about 90 per cent water, about 3 6 per cent protein, from 0 15 to 0 75 per cent fat, about 5 per cent lactose, and about 0 8 per cent ash In this country most of the skim milk is fed to cattle, or wasted entirely, though an increasing amount is being dried Skim milk is valuable for household uses and even may be used as a beverage, though it is obviously less desirable than whole milk It is too valuable to be wasted

Whey is a by-product from cheese manufacture It is less valuable than skim milk as it has lost most of its protein Whey butter and whey cheese are sometimes made Casein is the chief protein of milk It is usually separated from skim milk and

CHAPTER VIII

The Concentrated Milks

Among the few reasons why milk must be called the "nearly perfect food" and not the perfect food are its bulk and its tendency to spoil rather quickly. When milk comes from the cow it contains about 87 per cent water and, as is well known, it will not keep for more than two or three days. These slight disadvantages do not detract from the nutritional value of milk, but because of their economic importance, methods for the preservation of milk were sought many years ago.

As early as the year 1300 A.D. the Tartars were said to have used a scheme for keeping milk by making a concentrated paste of it. In the hot countries of the Orient and elsewhere, milk is promptly soured before using it. When canning was invented in *1809* by Nicholas Appert, who received an award of 12,000 francs from Napoleon for this benefaction to the race, it was claimed that the canning methods, using glass containers, would maintain milk and cream without change. This alleged accomplishment did not work, however, and a successful plan for the concentration and preservation of milk was not evolved until the middle of the nineteenth century.

GAIL BORDEN

The concentration of milk was the result of a humanitarian endeavor to provide pure milk on transatlantic ships In 1851 an American inventor, Gail Borden, was returning from Europe, where he had been presented with a medal at the first World's Fair, held in London He was shocked by the plight of the immigrant children on the vessel, whose chief food was salt meat and mouldy biscuit and not the milk which they should be getting To be sure, cows were carried in the hold of the ship, but the supply of milk from them was inadequate, soured quickly, and was extremely dirty The best of it went to the table of the first cabin passengers and not to the sickly children who really needed this sustenance

Gail Borden had received his medal at the Crystal Palace for the invention of a concentrated meat biscuit It occurred to him that milk might also be put up in concentrated form and he broached the subject to the ship's captain As in the case of most people who suggest innovations, his proposal met instant ridicule Gail Borden was, however, not the kind of man to be deterred by adverse criticism and when he reached America he proceeded to develop his idea

Two years later Mr Borden applied to the United

States Patent Office for a patent on a process for the concentration of milk During those two years he had been experimenting in a little laboratory placed at his disposal by the Shaker colony at New Lebanon, New York The peace loving Shakers were heartily in favor of his altruistic endeavors and they were glad to supply milk and other facilities for research This was before the era of sanitation, however, before germs had been discovered, and the milk was frequently dirty Gail Borden soon found that the dirt in milk had a definite effect on its keeping qualities, even after it had been concentrated He never forgot this lesson and later when he founded his great milk company was a pioneer in attempting to secure clean milk

Although Borden had devised a plan for preserving milk by reducing the water content in a vacuum, the United States Patent office at first refused to allow him a patent, on the ground that his invention lacked novelty and, strangest reason of all, usefulness When it was pointed out that the vacuum process was intended to keep out the air and was not merely a method for quicker evaporation of water, and after a number of eminent scientists had investigated the invention, the patent, No 15,553, was finally granted on August 19, 1856, about three years after the first application An English patent was also allowed about the same time

The manufacture of a condensed milk then began at a *factory* located in what is now Torrington, Connecticut. The customary vicissitudes of new ventures were soon experienced and Borden lost all his money, but not his spirit. He came back to Connecticut and in an old mill at Burrville began again. He was condensing milk successfully, but a financial panic put him out of business.

One day Borden was on a train en route to New York. He struck up a conversation with a stranger and told him about his work. The stranger was Jeremiah Milbank, a well known Wall Street financier, and he was so much impressed with the enthusiasm and rugged honesty of Borden, as well as the merit of his product, that he undertook to finance his project, and in February, 1858, they entered into a partnership. The first step was to open a sales office in New York City and to peddle the new milk product in pushcarts carrying 40 quart cans. The resulting sales from this primitive method of nearly three quarters of a *century ago allowed* the building of a large new factory which opened at Wassaic, New York, in June, 1861.

The Civil War began two months later and the federal government promptly *commandeered* the entire output of this factory for the use of the army. The soldiers soon learned to like this form of milk, which they received throughout the war. The story

is told that the cans dating from Civil War days are still kept by a number of families among their souvenirs of that conflict

The use of condensed milk in our Civil War resulted in the establishment of plants in other countries A war correspondent of the New York *Tribune*, Mr Charles A Page, who was later appointed American consul at Zurich, Switzerland was much impressed with the possibilities for making condensed milk in that country and sent for his three brothers to join him in the venture They organized the Anglo Swiss Condensed Milk Company which prospered in the European field and then invaded the United States in the eighteen-eighties In 1902 the American Branch of this business was acquired by the Borden Company and two years later its European interests were merged with those of the Nestle Company of Switzerland [1]

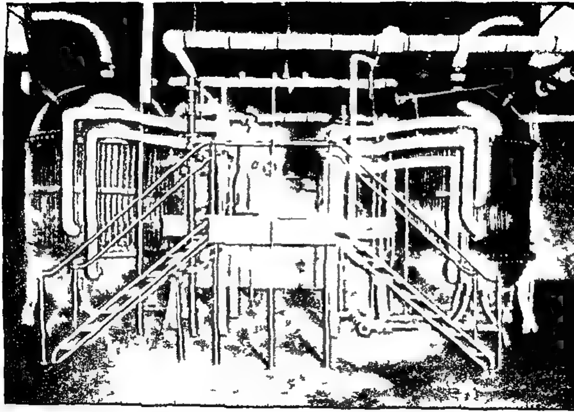
Another pioneer in the condensed milk industry was John B Meyenberg a Swiss who had been employed in the original plant of the Anglo Swiss Company at Cham Here he devised a process for preserving condensed milk without the addition of sugar, but since no particular appreciation of this useful invention was displayed in Europe, he migrated to the

[1] Hunziker, O F Condensed Milk and Milk Powder (4th ed) 1926

United States in 1884 and received a patent in that year and another in 1887 for his sterilization process With several others he organized in 1885 the Helvetia Milk Condensing Company, which was the first concern to market an unsweetened condensed milk in small sealed cans The original name bestowed on this product was "Evaporated Cream," which was thought justified by its high butter fat content, but after the passage of the Federal Food and Drugs Act of 1906, the term "Evaporated Milk" came into permanent use

CONDENSED MILK

The condensed milk first manufactured in quantity by Gail Borden was merely whole milk from which a considerable proportion of the water had been removed and to which nothing had been added This milk was distributed in large containers, though as early as 1856 milk was canned by Borden and sent around the world It was soon found that this condensed milk would keep longer and better if pure sugar were added, as the sugar inhibited the growth of bacteria and other organisms Up to 1885 when evaporated milk was first made successfully, most of the canned milk consisted of this sweetened condensed In 1927 there were produced in the United States 346,368,000 pounds of condensed milk and 1,509,354,000 pounds of evaporated



Modern Machinery for Condensing Milk Showing the Huge Vacuum Pans

The present methods of manufacture of sweetened condensed milk, which are based on the original Gail Borden process, are fairly simple, though requiring care and skill. Milk brought to the condensaries by farmers is first examined for quality and cleanliness and any which does not measure up to the proper specifications is rejected. On the other hand bonuses are paid for the purest milk. It is then standardized so that the finished product will conform to the federal requirements of not less than 8 per cent butter fat and 28 per cent total solids.

This clean, mixed milk is then placed in large tanks where it is rapidly heated to a temperature of about 206°F. The object of this preliminary heating is to destroy any bacteria and molds which might be present, to prepare the milk for the addition of sugar, and to prevent its burning when later condensed in the vacuum pan.

Refined sugar, or saccharose is next added to the milk and the mixture is transferred to huge vacuum pans, each holding some 10 tons. Here the milk is heated in the absence of air at a temperature of about 145°F and held at that temperature for about an hour or more. By that time, enough water has evaporated, so that one part of condensed milk is the equivalent of two and a half parts of whole milk.

When the desired amount of condensation has been reached, the product is gradually cooled to about

70°F in pipes surrounded by a solution of brine It then goes into automatic filling machines and is placed in sterile tin cans, which are hermetically sealed by machinery The final step is a laboratory test of each batch before the product is released for the market

The process described is that employed by one of the leading companies, which realizes that it is good business to endeavor by the most careful methods to produce clean and pure concentrated milk for use and consumption by individuals and families Condensed milk is also manufactured in bulk and used extensively in industry, such as in the making of bread, ice cream, and other articles

The average composition of sweetened condensed milk is as follows

	per cent
Fat	9 0
Protein	8 1
Lactose	11 8
Sucrose	42 0
Ash	1 7
Water	27 4

EVAPORATED MILK

Unsweetened condensed, or evaporated milk is made in much the same manner as the condensed, though there are some essential differences Tested and standardized whole milk is forewarmed at a temperature of about 203°F and is then condensed in

a vacuum pan So far the process is similar to that used for sweetened condensed milk, except, of course, that no sugar has been added, and the temperature in the vacuum pans is slightly less, about 130°F

Before the evaporated milk is cooled it is subjected to an important process known as homogenization, in order to break up the butter fat particles and blend them with the milk so that there will be no separation of fat in the can This process consists of sending the milk through a number of fine openings under a pressure of about 3500 pounds, with the result that a cream line is prevented and the milk is made even more digestible

The evaporated milk is then cooled and placed in sterile tin containers, which are hermetically sealed at once After this, the milk is sterilized in the cans for thirty minutes at a temperature of about 240°F This heating kills any bacteria present, so that evaporated milk is an absolutely sterile product Chemically, it differs from whole milk only in having less water

The average composition of evaporated milk is as follows

	per cent
Fat	7 85
Protein	6 [illegible]
Lactose	9 75
Ash	1 50
Water	74 05
	100 00

The special advantages of condensed and evaporated milks are discussed later.[2] On the transatlantic flight of the "Graf Zeppelin," made in 1928, a quantity of American made evaporated milk was carried as part of the food supply.

MALTED MILK

Although a patent for drying milk was granted in England in 1855 to a man named Grimwade, and desiccated milk was manufactured for several years thereafter, malted milk was the first milk in powdered form to achieve commercial success.[3] As in the case of condensed milk, its early development was inspired by humanitarian motives.

Because of difficulty in securing a clean and wholesome milk supply, a group of physicians went some fifty years ago to William Horlick, the manufacturer of a "baby food," and suggested that he endeavor to develop a powdered food made of milk and grains. After experiments lasting several years, a process for mixing barley flour with wheat flour and milk and reducing this product to a powder was perfected in 1883, though it was another four years before malted milk appeared on the market. In 1927, the number of pounds manufactured was 22,116,000.

As in the case of condensed and evaporated milks

[2] See p. 223.

only the purest and best grade of materials can be used in the manufacture of malted milk, for otherwise the results will be poor. Cleanliness is, likewise, a commercial necessity. The barley selected for malted milk must be mellow, uniform in hardness, and must be thoroughly rid of any impurities. The wheat flour must also be unblemished, and the whole milk must come from cows not only healthy but sanitary, so that bacteria are at a minimum and dirt is at zero.

Two steps are involved in the preparation of modern malted milk. The first is a most delicate one, as the barley grain must be induced to germinate just enough to grow a sprout, or what is known technically as an acrospire. When this appendage has formed properly the grain has developed an enzyme, a chemical substance which will attack starches and change them into simple sugars. This germination job is a complicated one, but it is performed and then at the right time the barley is placed in kilns, where it is dried, a step requiring about four days. The barley is then stored for several months.

This dried grain is known as barley malt and, being full of enzymes or ferments is ready and eager for action. It gets it by being mixed with water and wheat flour, which is rich in starch. The mixture, called a mash, is heated and in two or three hours the

enzymes have converted the starch into dextrin and maltose. To the mash extract is then added fresh whole milk and certain salts, after which the casein of the milk undergoes a certain amount of predigestion. The mixture is then condensed and dried in a vacuum pan or on a steel cylinder.

Out of this pan come hard, brittle, porous chunks, looking something like petrified sponges. These are ground into powder, placed in glass bottles or tin cans, and the finished product goes out to the drug store, the soda fountain, the grocery, and the home, to be consumed with profit and benefit by persons of all ages and classes. In the cases of babies it should, of course, be used only as prescribed by a competent regular physician, a principle which holds good for any kind of infant feeding. Malted milk has been found of particular value in the treatment of acidosis in infants. The real malted milk is a nourishing food because it contains protein to build tissues, fat and carbohydrate to supply fuel for the human machine, and minerals to assist in various bodily processes. It also possesses the indispensable vitamins.

Malted milk is now made by about half a dozen different firms in this country, with some variations in methods and some differences in quality. Probably three times as many concerns are manufacturing so-called chocolate malted milk or something like it. True chocolate malted milk or chocolate flavored

malted milk is merely real malted milk to which chocolate has been added before drying and sugar is added afterwards There are on the market many concoctions resembling or masquerading as chocolate malted milk and the buyer will be wise to secure his malted or chocolate malted milk only from the supplies put out by the old, reliable, well known concerns, whose products are invariably the best and are advertised as malted milk and not by an eccentric trade name

Physicians who take pictures of the gastro intestinal tract now use chocolate malted milk as the carrier for the opaque substance, barium sulphate, needed to show the conditions of the intestines by means of the X ray The product has many advantages for this purpose, such as its dense, yet not too bulky quality, and its agreeable flavor, which does not cause any psychic effect in the patient

The highest grade of malted milk exhibits certain characteristics and qualities It has a creamy color like the whole grain It is not too sweet, nor is it bitter, but has a smooth malt taste It should not be too readily soluble, as that may mean low protein content A malted milk which requires vigorous mixing is all the better because it contains more actual nourishment A real malted milk must have not less than 7 5 per cent fat according to federal standards, but some have nearly 9 per cent fat, 14

Since 1900 a number of patents for drying milk have been granted. In 1902 John A. Just invented and patented a process for desiccating milk on heated steel rollers, while in 1905 the Merrell brothers and W. B. Gere invented and patented another spray process. Beginning in 1913 C. E. Gray and Aage Jensen secured several patents for still another spray process. Other inventors have also obtained patents for drying milk, but the spray process is the one now most in use, though a considerable quantity of dried milk is manufactured by the roller process.[8]

In the spray process, tested milk is first condensed in a vacuum in order to reduce the water content. It is pasteurized and then forced under high pressure through fine nozzles into a steel chamber, heated to a temperature of about 270° F. The moisture evaporates and rises and the remaining powder collects at the bottom of the chamber, from which it is removed at once and placed in tin containers.

In the roller process, whole milk is condensed and then poured upon revolving steel drums, heated to a high temperature. The milk dries immediately and is automatically scraped from the drum into receptacles and then placed in tin cans. Both of these processes are rapid, consuming only a few seconds.

[8] Miyawaki, A. Condensed Milk. A Study of Condensed Evaporated and Powdered Milk. John Wiley, 1928.

The average composition of dried whole milk is as follows

	per cent
Fat	28 0
Protein	27 0
Lactose	38 0
Ash	5 2
Water	1 8
	100 00

In addition to powdered whole milk, skimmed milk is also dried, and various milk combinations, such as powdered protein milk, powdered lactic acid milk, and several breast milk imitations are manufactured especially for infant feeding Dried skimmed milk is employed extensively in industry, particularly for bread making and other bakery products, ice cream, confectionery, and in other edible articles Buttermilk and whey are likewise now dried In 1927 the total production of all dried milk products amounted to 186,393,000 pounds, of which about 64 per cent consisted of dried skimmilk, 20 per cent of dried buttermilk, and 6 per cent of dried whole milk In 1916 the entire output aggregated only 18,929,000 pounds, and in 1926 was 50,000,000 less than in 1927

VITAMINS IN THE CONCENTRATED MILKS

The question naturally arises as to the effect of the manufacturing processes on the nutritive qualities of

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VITAMINS IN THE CONCENTRATED MILKS

The question naturally arises as to the effect of the manufacturing processes on the nutritive qualities of

the condensed milks Of the known vitamins research has shown that the only one which is seriously affected is vitamin C, the antiscorbutic, which prevents the development of the disease known as scurvy This vitamin is easily destroyed by heat in the presence of air It is, therefore, entirely lacking in evaporated milk and is reduced about one-half in condensed and dried milks This vitamin is abundant in fruits, which are now regular parts of most diets and so its loss or reduction in the concentrated milks is not serious There is, for instance, about as much of a loss of vitamin C in pasteurized whole milk, and orange or tomato juices have long been recommended and used as supplements to milk in infant and child feeding

Vitamin A, in many respects the most important of all these essential accessory food factors, is stable to heat and so is unchanged as a result of the concentration processes Vitamin B, now considered to have at least two parts, is not altered in either respect in condensed or powdered milk, and apparently is only very slightly reduced in evaporated As far as known, the heating processes have no effect on vitamins D or E, the antirachitic and antisterility factors respectively

Not only is the vitamin content of a concentrated milk nearly the same as that of the fluid milk from which it is made, but there have been no other changes

influencing the nutritive quality The natural fats, proteins and carbohydrates are relatively unaffected by any concentration process The milk casein is broken up, but the only consequence of that change is to render the concentrated milks much more digestible than whole milks, either raw or pasteurized In the dried and condensed milks there may be a slight precipitation of the salts of the minerals, but since whole milk contains an excess of these, there is no loss of nutritive effect and no change in physiological action The enzymes and lactalbumen are likewise unaltered in the concentrated milks A canned milk may, therefore, be used for all of the same purposes as a bottled milk, and it should be borne in mind that milk is still cow's milk whether it comes in 40 quart cans, in 1-quart glass bottles, or in 14- or 16 ounce tin cans Because of their compactness, the concentrated milks are unusually valuable for cooking and household purposes

ADVANTAGES OF CONCENTRATED MILKS

Besides the benefit of superior digestibility conferred by the drying or condensing of milk, due to a soft, flocculent condition of the curd, the concentrated milks have several other advantages The most important of these is safety, for security from the possibility of spreading disease is one of the first essentials of any milk supply The heating processes

are effectual in destroying all dangerous bacteria if any are present in the milk The most resistant of these is the tubercle bacillus, and this germ succumbs in one minute to a temperature of 212°F and in twenty minutes to a temperature of 140°F The thermal death points of other disease-producing bacteria is lower than that of the bacillus of tuberculosis

In addition to safety and digestibility, other advantages of the concentrated milks are cleanliness, uniformity, convenience, cheapness and stability Ordinary whole milk will spoil in a few days, but these concentrated milks, packed in hermetically sealed sterile containers, will keep without ice for long periods The powdered milk known as Klim, which is packed by a special process in an inert gas, can be stored almost indefinitely These keeping qualities are of special value in connection with travelling, camping, use in the tropics, and in all situations where it is impossible or difficult to obtain clean and safe whole milk *After the cans are opened, evaporated* milk will, of course, spoil rather quickly, and dried milk soon, but sweetened condensed will keep even then for a considerable period, especially if it is protected, as by placing an inverted tumbler over the opened can

Of the 115 billion pounds (13 4 billion gallons) of milk now produced annually in this country, only about 4 per cent goes into the manufacture of the

various dried, condensed, and evaporated milks The quantity is growing, however, and the time may come when the greater proportion of our milk is is concentrated form . Because of its many sanitary and economic advantages, this is the milk supply of the future, though it is improbable that powdered milk will supersede whole milk supplies in our large cities in the next few years Some time ago the late Dr Hermann M Biggs, State Commissioner of Health of New York, prophesied that eventually all milk would be in concentrated form His forecast has not yet come true, but as the public comes to appreciate the safety, uniformity, stability, digestibility, nutritional quality, convenience, and inexpensiveness of the concentrated milks, this prophecy of Dr Biggs may eventually be more nearly accomplished

to indicate that this flavor develops more rapidly in pasteurized than in raw milk, though this is, of course, no reason for not securing properly pasteurized milk, which is the safest milk It is, however, a reason for not leaving milk too long in the sun Where a so called "window ice box," simply the window ledge in winter is employed, it should be shaded from the rays of the sun

The ice box or refrigerator in which milk is placed in the home should be maintained in a clean and sanitary condition as well as a cold one The milk should be kept covered, preferably in the bottle with the cap on, *for uncovered milk may absorb flavors and* odors from pungently flavored food Milk should likewise not stand uncovered for any length of time in the kitchen It should not be poured out until those who are going to consume it or use it are ready to do so Evaporated and condensed milks should be kept in the ice box after the can has been opened, and they may be left in the can

The best grades of bottled milk have two caps, an inner one set flat within the neck of the bottle, and an outer one, which covers enough of the side of the top part of the bottle to keep it clean and free from contamination When bottled milk has only one cap and the top of the bottle has been exposed to handling dust, and other pollution, the top and neck should be washed off with clean water before

ICING THE MILK. AN IMPORTANT FACTOR IN A CLEAN AND PURE MILK SUPPLY

pouring the milk. Before opening canned milk, the top of the can should always be cleansed and a clean can-opener used

After the bottles have been emptied they should be cleansed in hot water Milk bottles should never be used as containers of oil, paint, kerosene, chemicals, or other substances which are or may be harmful if allowed to enter the human system Milk bottles should be returned promptly to the proper dealer, because they are expensive It is no more than right and fair for the householder to cooperate with the dealer in preventing waste and promoting the cleanliness of his milk bottles, for in so doing the householder is promoting his own interests as well as those of the public

When a case of contagious disease occurs in a house, the milk bottles should be treated or disposed of in accordance with the instructions of the local health officer If such bottles are used only in the kitchen and are not handled by persons coming in contact with the sick individual, and are thoroughly washed and scalded before returning to the dealer, there is no danger from their use, especially if they are sterilized again by the milk dealer Precautions must be taken, however, to ensure safety

In a few localities there still persists the antiquated and improper system of putting out a receptacle into which a milk dealer pours a certain amount of milk,

This procedure is wrong, and should be done away with, but if necessity compels its use, the receptable should be a clean piece of crockery with a proper cover Milk tickets, notes and other possibly dirty material should not be placed in the receptable

Old milk and new milk should not as a general rule, be mixed, for old milk is or may be higher in bacteria Cold and warm milk should also not be mixed When some milk has been poured from the bottle, it is best not to replace it in the bottle If milk has been frozen, its structure is altered somewhat, with a separation of free fat, but there are apparently no resulting deleterious effects when it is consumed by adults Frozen milk may be heated before use and can then be generally employed for the usual purposes, though milk which has been frozen often disagrees with infants One advantage of condensed and powdered milks is that they will not freeze

Flies should be kept away from milk, just as they should be banned from contact with all other foods Flies are carriers of filth and germs and no well ordered household will tolerate them

PRACTICAL MILK RECIPES

Prepared by Helen Rich Baldwin

In the following pages will be found many tested recipes for the practical use of whole milk, skim

milk, sour milk, malted milk, and various milk products All of these recipes are for dishes which can actually contribute to good health and no indigestible or harmful combinations are included

These recipes are arranged in the following order

I Whole milk recipes
II Sour milk recipes
III Sweetened condensed milk recipes
IV Evaporated milk recipes
V Dried and powdered milk recipes
VI Malted milk recipes
VII Cream recipes
VIII Cheese recipes
IX Butter recipes
X Ice cream recipes

I Whole Milk Recipes

1 White Bread

2 cups scalded milk
1 tablespoonful lard
1 tablespoonful butter
2½ teaspoonsful salt
1 yeast cake dissolved in ½ cup lukewarm water
6 cups sifted flour or 1 cup white flour and enough entire wheat flour to knead

Put butter lard sugar and salt in a large bowl Pour in 1 cup of hot milk Stir, then add second cup of milk

Dissolve yeast cake in ½ cup lukewarm water When first mixture is lukewarm add yeast cake mixture and 6 cups of flour Then stir until thoroughly blended using knife or mixing spoon Turn out onto a floured board leaving a clean bowl knead until mixture is smooth and elastic to touch and bubbles may be seen under the surface

Return to bowl, cover, and let rise for 3 hours. Cut down and turn over with a case knife. (This checks fermentation for a short while) Place on a board slightly floured, knead, shape into loaves or biscuits Place in greased pans and set in a warm place until bulk is doubled

Bake in a hot oven (400°–450 F) about 40 minutes Bread made in this way may be mixed and baked in 5 hours

2 Whole Wheat Bread (Variation)

Instead of 6 cups white flour use 1 cup white flour and 4½ cups entire wheat flour and proceed the same as for white bread

3 Chocolate Pie

1½ squares chocolate
1¾ cupsful scalded milk
¾ cupful powdered sugar
½ tablespoonful cornstarch
¾ teaspoonful vanilla
4 eggs
6 tablespoonsful sugar
Pastry

Line a medium-sized pie plate with pastry having a fluted edge Melt the chocolate over hot water then add the hot milk and cook together until smooth Add the sugar sifted with the cornstarch and stir until the boiling point is again reached Cool slightly pour over 1 whole egg the yolks of 3 eggs slightly beaten and ¼ teaspoonful of vanilla Pour into the pastry lined pie plate and bake Cover with a meringue made from the 3 egg whites, granulated sugar and ½ teaspoonful of vanilla Brown at 300 F for 15 minutes.

4 Tapioca Cream

4 tablespoonsful pearl tapioca
4 cups milk
4 tablespoonsful sugar
4 eggs
2 teaspoonsful vanilla

Soak tapioca in 1 cup cold water several hours or overnight. Cook in double boiler in the milk until tapioca is perfectly clear Add sugar and egg yolks beaten smooth a pinch of salt, any flavoring to taste Cook 3 minutes pour in buttered pudding dish

5 *Standard Cake Recipe with Variations*

⅓ cup butter
1 cup sugar
2 eggs
½ teaspoonful vanilla
1½ cups pastry flour
2 teaspoonsful baking powder
¼ teaspoonful salt
½ cup milk

Cream butter, add sugar and yolks of eggs well beaten Sift dry ingredients and add alternately with milk Fold in the stiffly beaten egg whites Flavor Fill one half full a well buttered and floured pan and bake in a moderate oven about 50 minutes

This recipe makes 1 medium loaf

For a deep cake use a hollow centered pan When baked in a shallow oblong pan if cut in half the two halves may be used as layers and any of the frostings may be used Mocha frosting is excellent with the loaf cake and caramel or chocolate frosting with any of the other cakes

6 *Graham Muffins*

1 cup graham or whole wheat flour
1 cup flour
4 tablespoonsful sugar
½ teaspoonful salt
1 cup milk
1 egg
3 tablespoonsful butter
4 teaspoonsful baking powder

Sift and mix dry ingredients add slightly beaten egg to milk and add gradually melted butter last Fill well buttered muffin pans half full and bake in a moderate oven 25 or 30 minutes

7 Steamed Shirred Eggs

4 eggs
2 cups milk
1 teaspoonful salt
4 teaspoonsful butter

Beat 4 eggs thoroughly and blend with the milk and salt stirring mixture until smooth Put 4 teaspoonsful of butter in top of double boiler and melt. Add egg mixture Be sure water is boiling in bottom of double boiler Do not remove cover for 7 minutes then serve by turning out onto a plate This makes a thick unsweetened custard

8 Cocoa

3 tablespoonsful cocoa
4 tablespoonsful sugar
2 cups milk
4 cups milk

Mix thoroughly 3 tablespoonsful of cocoa and 4 tablespoonsful of sugar Gradually add 2 cups of milk stirring smooth. Cook this over direct flame for 5 minutes stirring constantly then turn into top of double boiler and add remaining 4 cups of milk beating with a dover egg beater until there is a froth on top ½ teaspoonful vanilla may be added

9 Egg Nog

1 egg
Sugar
Salt
¾ glass of milk
Vanilla

Beat the white and yolk of egg separately Add to the beaten yolk a little sugar and a little vanilla a pinch of salt and milk Then add the beaten white and stir together in bowl. The amount of salt sugar and flavoring can best be determined by tasting, as the egg nog must be neither sweet nor salty

10 Caramel Junket

2 tablespoonsful sugar caramelized
4 tablespoonsful water
3 tablespoon ful granulated sugar
Few grains salt
½ teaspoonful vanilla
1 pint milk
½ junket tablet

Add water to caramel sugar and cook to thick syrup Add syrup, sugar salt and vanilla to milk and cool to blood heat Dissolve junket tablet in cold water add to the tepid mixture and pour at once into serving dishes

II Sour Milk Recipes

1 Gingerbread

1 cup molasses
1 cup sour milk
2⅓ cups flour
1¾ teaspoonful soda
2 teaspoonfuls ginger
½ teaspoonful salt
½ cup melted butter

Mix soda with sour milk and add to molasses Sift together remaining dry ingredients combine mixtures, add butter and beat vigorously Pour into a buttered shallow pan and bake thirty minutes in a moderate oven

2 Sour Cream Dressing

1 cup thick sour cream
1 egg
½ teaspoonful salt
¼ teaspoonful mustard
Paprika
Lemon juice

5 Boston Brown Bread

1 cup cornmeal
1 cup rye flour
1 cup graham flour
¾ teaspoonful soda
1 teaspoonful salt
¾ cup molasses
2 cups sour milk
1 cup chopped raisins (optional)

Mix dry ingredients Stir in gradually molasses and milk Beat well and add chopped fruit which has been slightly floured Pour into well-greased molds or cans and steam for 1½ hours Then set in a slow oven for about 20 minutes to dry off and form good crust.

III Sweetened Condensed Milk

1 Cocoanut Cookies

½ cup condensed milk
1 cup shredded cocoanut

Mix condensed milk and cocoanut together, and drop by teaspoonsful on buttered pan about 1 inch apart Bake in moderate oven until a delicate brown (½ teaspoonful vanilla may be added)

2 Chocolate Frosting

3 squares unsweetened chocolate
1⅓ cups sweetened condensed milk
1 tablespoonful water

Melt chocolate in double boiler and add condensed milk, stirring over boiling water 5 minutes until it thickens Add water Cool cake before spreading frosting (4 squares of chocolate may be used if bitter sweet icing is desired)

3 Baked Ham René

Slice uncooked ham (1 inch thick)
Prepared mustard

¾ cup sweetened condensed milk
1 cup hot water

Pan broil ham on both sides for a minute Spread with mustard to cover well (¼ inch thick) Mix condensed milk with hot water until thoroughly blended and pour over ham in baking pan. Bake in moderate oven (350 F) with pan covered for 15 minutes then remove cover and cook until tender and liquid is absorbed (about 30 minutes) May be served with pineapple rings or fried apple rings. (Mustard may be omitted)

4 Spanish Corn Pudding

½ cup sweetened condensed milk
1 can (2½ cups) green corn
½ cup chopped green pepper
2 tablespoonsful pimento pepper chopped
1 tablespoonful chopped onion
1 teaspoonful salt
2 eggs, beaten

Blend together thoroughly all the ingredients Pour into a buttered baking dish and bake in a moderate oven (350°F) for about 25 minutes Serve as an entree or as the main course of a light dinner

5 Caramel Pudding

Unopened can of sweetened condensed milk

Place unopened can of sweetened condensed milk in a kettle of boiling water and keep at boiling point for 2½ hours, being careful to keep can covered with water Remove from water and chill thoroughly At serving time remove top of can cutting along the side so that the contents may be removed whole Place on a serving dish garnish with broken nut meats and whipped cream. To serve individually cut in slices garnish with nut meats and whipped cream—or use plain unsweetened cream with or without garnish

Note Many uses will be found for this delicious dainty For convenience and to save fuel, caramelize two or three cans at one time and keep in ice box for quick use

IV Evaporated Milk Recipes

1 Gingerbread Pudding

4 egg yolks
1 quart milk (or 2 cups evaporated
milk and 2 cups of water)
$\frac{1}{3}$ cup sugar
3 teaspoonsful vanilla
$\frac{1}{4}$ teaspoonful salt
2 cups gingerbread crumbs
4 egg whites
3 tablespoonsful sugar

Beat yolks of egg add sugar salt vanilla and milk Fold in *gingerbread crumbs Pour into pudding dish Bake in moderate* oven Whip whites of egg until stiff add 2 tablespoonsful sugar and pile lightly on cooked pudding and brown in oven Serve hot or cold

2 Chocolate Fudge

2 squares unsweetened chocolate
2 cups sugar
$\frac{1}{8}$ teaspoonful cream of tartar or 2
tablespoonsful corn sirup
$\frac{3}{4}$ cup evaporated milk
$\frac{1}{4}$ cup water
2 tablespoonsful butter
1 teaspoonful vanilla

Shave or break the chocolate in small pieces put into saucepan and melt over hot water Add the sugar corn sirup or cream of tartar and milk diluted with water Cook slowly stirring until the ingredients are well blended and the sugar dissolved Boil until the mixture forms a soft ball (238 F) when tested in cold water Remove from the fire, add the butter, but do not stir it in Let stand

V Dried or Powdered Milk Recipes

1 Creamed Vegetables

(Serves 4 dinner portions)

Basic white sauce

1 tablespoonful flour
4 tablespoonsful dried milk
½ teaspoonful salt
¼ teaspoonful pepper
1 cup vegetable water (chilled)
1 tablespoonful butter

Thoroughly mix 1 tablespoonful flour 4 tablespoonsful dried milk, ½ teaspoonful salt and ¼ teaspoonful pepper Gradually add 1 cup of chilled liquid in which vegetables were cooked. Stir smooth cook stirring continuously until mixture thickens Cook 10 minutes longer stirring occasionally Remove from fire and add 1 tablespoonful of butter

Small White Onions

1 cup small white onions peeled
1 teaspoonful salt
2 cups water
1 cup white sauce

First Step Place 1 cup small white onions (peeled) 1 teaspoonful salt and 2 cups of water in a saucepan and cook until onions are tender Strain, having one cup of liquid that onions were cooked in chill.

Final Process Combine the 1 cup of white sauce and the 1 cup of boiled onions Reheat and serve

Carrots

1 cup diced carrots (Wash and scrape young carrots cutting in ½ inch dice)

First Step Substituting 1 cup diced carrots for 1 cup onions

White Sauce Substituting 1 cup of chilled liquid in which carrots were boiled for onion liquid

Final Process Substituting 1 cup of carrots for 1 cup of onions

Cauliflower

1 small head cauliflower

First Step Remove leaves cut off stalk of 1 small cauliflower Soak head down in cold water 30 minutes Substitute cauliflower for onions cooking head up

White Sauce Substituting 1 cup of chilled liquid in which cauliflower was boiled for onion liquid

Final Process Either separate flowerets with fork and blend with white sauce or place head of cauliflower on platter and pour white sauce over it

Brussels Sprouts

½ basket of brussels sprouts

First Step Remove the dry leaves or bad spots from ½ basket of brussels sprouts Substitute them for 1 cup onions

White Sauce Substitute 1 cup of chilled liquid in which brussels sprouts were boiled for onion liquid

Final Process Substituting ½ basket brussels sprouts for 1 cup of onions

2 Creamed Soups

(Serving 4 to 6 portions)

Basic white Sauce

2 tablespoonsful flour
8 tablespoonsful dried milk
1 teaspoonful salt
½ teaspoonful pepper
3 cups vegetable water
2 tablespoonsful butter

Thoroughly mix 2 tablespoonsful of flour 8 tablespoonsful of dried milk 1 teaspoonful salt and ½ teaspoonful pepper Gradually

add 3 cups of the liquid saved from the vegetables when strained during the first mixture (If not 3 cups of water after vegetable is cooked use water from tap) Stir smooth Cook stirring constantly until mixture thickens Cook 10 minutes longer, stirring occasionally . Remove from fire and stir in 2 tablespoonsful of butter

Tomato

1 pint stewed tomatoes
1 small onion
1 teaspoonful salt
3 cups water

First Mixture Strain 1 pint of stewed tomatoes, saving both pulp and liquid Set liquid aside Place pulp 1 small onion, (finely sliced) 1 teaspoonful salt, and 3 cups of water in a saucepan and boil 2 minutes.

Final Process Combine white sauce with the tomato mixture Reheat and serve.

Mushroom

½ pound mushrooms or 1 small can
2 stalks celery cut finely
4 tablespoonsful chopped parsley
1 small onion
1 teaspoonful salt
3 cups water

First Mixture Place ½ pound of mushrooms (cut in medium pieces) 2 stalks of celery (cut fine) 1 small onion (finely sliced) 1 teaspoonful salt and 3 cups water in a saucepan and cook until mushrooms are tender - Strain saving both mushrooms and liquid. Cool liquid

White Sauce Same as above Substituting 3 cups of the water in which the mushrooms were cooked for the tomato liquid

Final Process Combine white sauce with the mushrooms. Reheat and serve Garnish each portion with a sprinkle of chopped parsley

Celery

1 cup celery cut in small pieces
4 tablespoonsful chopped parsley

First Mixture Substitute 1 cup chopped celery for ½ pound of mushrooms and proceed as in recipe above

White Sauce Substituting 3 cups of the water in which the celery was cooked for the liquid drained from the tomatoes

Final Process Combine white sauce with celery Reheat and serve Garnish each portion with a sprinkle of chopped parsley

Potato

1½ cup freshly mashed potatoes
4 tablespoonsful chopped parsley
1 small onion
1 teaspoonful salt
3 cups water

First Mixture Place 1 small onion (finely chopped) 1 teaspoonful salt and 3 cups of water in a saucepan and boil 2 minutes Strain saving water Chill this liquid

White Sauce Substituting 3 cups of the liquid in which the onion was boiled for the tomato liquid

Final Process Combine white sauce with mashed potato Reheat and serve Garnish each portion with chopped parsley

3 Baking Powder Biscuits

2 cups flour
4 teaspoonsful baking powder
3 tablespoonsful dried milk
½ teaspoonful salt
2 tablespoonsful butter
¾ cup water

Mix and sift 2 cups of flour 4 teaspoonsful of baking powder 3 tablespoonsful of dried milk and ½ teaspoonful of salt Cut in 2 tablespoonsful of butter with a steel fork or two paring knives Add ¾ cup of water mixing to a soft dough Toss onto a floured

board, and pat and roll to ½ inch thickness. Shape with a biscuit cutter. Place on greased pan and bake in a hot oven (400°–450°F.) 12 to 15 minutes.

4. Mashed Potatoes

Potatoes to make 2 cups when
mashed
2 tablespoonful butter
3 tablespoonful dried milk
1 teaspoonful salt
⅛ teaspoonful pepper

Boil potatoes with jackets on until soft. Remove from fire, peel and mash with potato masher or fork. Measure. Be sure there are two cups after potatoes are mashed. Cream 2 tablespoonsful of butter. Mix 3 tablespoonsful dried milk, 1 teaspoonful salt and ⅛ teaspoonful of pepper and work into creamed butter, beating smooth. Add mixture to 2 cups of mashed potato beating with a fork. Gradually add ½ cup of water, beating until smooth and creamy.

5. Cereal Cooked in Milk

1 quart water
½ teaspoonful salt
⅓ cup dried milk
1 cup { Wheatena / Farina / Malt Breakfast Food }
or
1⅓ cup oatmeal

Place 1 quart of water and ½ teaspoonful of salt in a saucepan over direct flame. Mix ⅓ cup of dried milk with 1 cup of cereal thoroughly. When water boils add cereal mixture and stir rapidly to avoid lumping, cook 5 minutes over direct flame stirring constantly, then place in top of double boiler and let cook from ½ to 1 hour.

VI Malted Milk Recipes

1 Malted Milk with Oyster Broth

Mix 1 teaspoonful malted milk with a little hot water Add 3 tablespoonful oyster juice pinch of salt and hot water to fill cup Mix well.

2 Chocolate Malted Milk Drink (Cold)

Mix to a smooth paste 3 heaping teaspoonful chocolate flavor malted milk with a little cold milk Add milk to fill glass Two tablespoonsful cracked ice or 1 tablespoonful ice cream may also be added Shake well

3 Chocolate Malted Milk (Hot)

Mix 3 heaping teaspoonsful chocolate malted milk to a paste with a little hot milk (or water) Fill cup with more liquid stirring constantly

4 Chocolate Charlotte Russe

½ pint whipping cream
3 heaping tablespoonsful chocolate malted milk
½ teaspoonful vanilla

Whip ½ pint cream until stiff Add vanilla measure chocolate malted milk and fold into mixture evenly Serve in sherbet glasses Garnish with maraschino cherry

VII Cream

1 Vanilla Ice Cream

2 cups scalded milk
1 cup sugar
2 tablespoonsful flour
Yolks 2 eggs
1 teaspoonful gelatin
1 tablespoonful cold water
1½ pints heavy cream
2 teaspoonsful vanilla

Scald the milk in the double boiler and add the sugar and flour which have been thoroughly mixed Cook for 15 or 20 minutes. Pour over the beaten egg yolks, return to the fire and cook for 2 minutes or until the mixture coats the spoon Add to this while hot, the gelatin, which has soaked for 5 minutes in 1 tablespoonful of cold water, and chill the mixture Whip the cream until stiff and fold into the cooked mixture Add 2 teaspoonsful of vanilla and ¼ teaspoonful of salt Pour into the tray of the refrigerator and freeze stirring every 30 minutes until the mixture will hold its shape The recipe serves 6 to 8

2 *Maple Sugar Candy*

1 pound soft maple sugar
¾ cup thin cream
½ cup boiling water
¾ cup English walnut or pecan meats, cut in pieces

Break sugar in pieces, put in a saucepan with cream and water Bring to a boiling point, and boil until a soft ball is formed when tried in cold water Remove from fire beat until creamy, add nut meat and pour into a buttered tin Cool slightly, and mark into squares

3 *Bavarian Cream (With Eggs)*

1½ tablespoonsful gelatin
¼ cup cold water
2 egg yolks
½ cup sugar
1½ cup scalded milk
⅛ teaspoonful salt
1 teaspoonful vanilla
2 egg whites
1 cup cream

Soak gelatin in water 5 minutes Beat egg yolks. Add sugar and scald milk slowly, stirring return to double boiler, add gelatin and salt. Cook until thickened Remove and cool. Add beaten

egg white cream whipped and vanilla Pour into cold wet mold and chill Serves 6

4 Pineapple Mousse

1 tablespoonful granulated gelatin
½ cup cold water
1 cup pineapple syrup
2 tablespoonsful lemon juice
1 cup sugar
1 quart cream

Heat 1 can pineapple, and drain To 1 cup of the syrup, add gelatin soaked in cold water lemon juice and sugar Strain and cool As the mixture thickens fold in the whip from cream Mould, pack in salt and ice and let stand four hours

5 Squash Pie

1 cup squash, steamed and strained
1 cup heavy cream
1 cup sugar
3 eggs slightly beaten
Cinnamon, Nutmeg } 1 teaspoonful each
Ginger, Salt } ½ teaspoonful each
½ teaspoonful mace

Line a deep pie plate with puff paste Brush over paste with white of egg slightly beaten and sprinkle with stale bread crumbs fill, and bake in a moderate oven Serve warm

VII Cheese Recipes

1 Cottage Cheese

Cottage cheese is made from thick sour milk placed over a gentle heat and allowed to come to a temperature of 96 No higher

Mix first five ingredients, add yolks of eggs well beaten Fold in whites of eggs beaten until stiff Pour into a buttered baking dish, and bake in a moderate oven until baked through Serve at once

5 Cheese Cakes

1 cup sweet milk
1 cup sour milk
1 cup sugar
Yolks 4 eggs
Juice and grated rind one lemon
½ cup almonds blanched and chopped
¼ teaspoonful salt

Scald sweet and sour milk strain through cheese-cloth To curd add sugar yolks of eggs slightly beaten, lemon and salt Line patty pans with paste, fill with mixture, and sprinkle with chopped almonds Bake until mixture is firm to the touch

6 Pineapple and Cheese Salad

Shape cheese balls round and make about 1 inch thick Roll in chopped parsley peanuts or walnuts, (chopped) or sprinkle with paprika Place on rings of pineapple

IX Butter Recipes

1 Hollandaise Sauce

½ cup butter
½ tablespoonful vinegar or 1 table spoonful lemon juice
2 egg yolks
¼ teaspoonful salt
Few grains cayenne

Divide the butter into 3 pieces Put 1 piece in a double boiler with vinegar or lemon juice and egg yolks Stir constantly with a wire whisk or spoon until butter is melted Add second piece of

butter, and, as mixture thickens, add third piece. Remove from fire add salt and cayenne. If mixture curdles, add 2 tablespoons of heavy cream. This is very delicious with vegetables or fish.

2 Quality Paste

2 cups flour
$\frac{1}{4}$ cup lard
$\frac{3}{4}$ cup butter
Ice water

Put flour in bowl, add lard, and cut it in with knife. When finely chopped add water to make a very stiff dough, using as little as possible. Cut the butter into the dough leaving it in rather coarse pieces. Chill in icebox for several hours or over night. Place ball of paste on floured cloth, pat and roll out. Fold so as to make three layers, turn half way round pat and roll out. Pat, roll and fold four times, shape and bake at once in hot oven.

3 Cream of Lima Bean Soup

1 cup dried lima beans
3 pints cold water
2 small onions
1 small carrot
1 cup milk
2 tablespoonsful butter
2 tablespoonsful flour
1 teaspoonful salt
$\frac{1}{8}$ teaspoonful pepper

Soak beans over night. In the morning drain and add the cold water, cook until soft with onions and carrot and rub through sieve. Melt butter in saucepan and add flour, salt and pepper. Stir butter mixture into boiling soup and add milk before serving.

Dried peas or lentils may be used in place of lima beans.

4 Waffles

1 cup milk
1$\frac{3}{4}$ cups flour

½ teaspoonful salt
3 teaspoonsful baking powder
2 eggs
3 tablespoonsful melted butter

Mix and sift dry ingredients, add milk gradually, yolks of eggs well beaten butter and whites of eggs beaten stiff Cook on a greased hot waffle iron Serve with syrup

5 Rich Cookies

½ cup butter
½ cup sugar
1 egg well beaten
¾ cup flour
½ teaspoonful vanilla
Raisins nuts or citron

Cream butter add sugar gradually, egg flour and vanilla Drop small portions from tip of spoon on buttered cookie sheet 2 inches apart. Spread thinly with knife dipped in cold water May garnish with nuts or raisins Use moderate oven Makes about 36 cookies

6 Mocha Frosting

2 tablespoonsful cocoa
½ cup butter
2 tablespoonsful black coffee
½ teaspoonsful vanilla
1 cup confectioners sugar

Cream butter and sugar Add vanilla and cocoa Add coffee to make the right consistency to spread

X Ice Cream Recipes

1 Ice Cream Sandwich

Spread a layer of ice cream (any flavor) between 2 slices of sponge cake place on a plate and serve with whipped cream or a fudge or caramel sauce

2 Ice Cream Variations

The recipes given here will suggest many other delicious frozen desserts, for instance you may use a vanilla ice cream recipe as a basic recipe varying the flavor as you wish by adding any of the following chopped nut meats (walnut almond, pecan pistachio and peanuts), chopped candied fruit, crystallized ginger cut fine raisins maraschino cherries grapenuts, crumbled macaroon An other tempting variation is to mold vanilla ice cream and just before serving roll in chopped nut meats, shredded cocoanut and grated sweet chocolate

CHAPTER X

How the World Gets Its Milk

There is a tinge of real romance in the way the world gets its milk, for different peoples employ various methods, sometimes primitive, sometimes modern, but always interesting and picturesque. Ever since the distant days when man followed the herd in order to get his sustenance from it, milk has been and still is used to some extent by practically all races and peoples throughout the world. The present day efforts to secure milk offer many dramatic pictures, in the gallery of which it is worth while to ramble for a while.

THE ANIMALS GIVING MILK

The word "milk," without other qualifications is generally understood, at least in this country, to refer to cow's milk. The cow is, nevertheless, only one of many animals throughout the world whose milk is commonly used for human consumption. Among the other lactating servants of man in various countries are goats, sheep, buffaloes, yaks, zebus, mares, asses, camels, sows, llamas, and reindeer. Even whales, as mammals, produce milk which has been

employed by man, but whale milk has not yet assumed a role of any importance in the milk industry

There are in the world about half a billion cattle, the term "cattle" referring only to domesticated bovine animals of two species, the European, known scientifically as the *Bos taurus typicus*, and the Indian and African humped zebu, called *Bos taurus indicus* Sheep, goats and musk oxen are not cattle, but belong in the general family of bovidae, which also includes antelopes, though deer are affiliated with still another family, the cervidae The unicorn mentioned in the Bible was probably an antelope seen in profile, so that the antlers appeared as a single horn Bison and buffaloes are cousins of cattle and are admitted to the *bos* group of animal life

Most of the world's cattle are raised for beef or for purposes other than milking, as only 175,000,000 out of the estimated total of 500,000,000 are devoted to the business of dairying In the United States there are some 65,000,000 cattle, of which nearly 25,000,000 are dairy animals, representing the greatest valuation of any one country The only other animal whose milk is used in America is the lowly goat, but she serves in that capacity to a limited extent only, except in some parts of Latin America

There is today an enormous variety of cows They are of all shapes, sizes, colors, and types, for there has been a tremendous mixing of breeds since the days of

the hairy Urus and the Celtic shorthorns from which all modern cattle, except the zebu, are considered to be descended. Old Urus, scientifically called *Bos primigenius*, ran wild in the Pleistocene period with the mammoth and other prehistoric animals. It was probably first domesticated in Neolithic times, though just when no one knows.[1]

The wild Urus was a magnificent animal, often attaining a height of six feet and a length of twelve. It had large horns which turned forward and which when used as drinking horns in the days of Tacitus and Pliny held as much as 12 liters, or nearly 13 quarts. Caesar, who described this animal, the "aurochs" of the Teutons, said that it approached the elephant in size. It was he who gave it the name Urus.

Fossils of the big Urus have been discovered in the remains of the lake dwellers of Switzerland, whose civilization existed somewhere between 4000 and 2000 B.C. More abundant there, however, are the bones of the Celtic shorthorn, or "little marsh cow," which was certainly tamed, for it is known that the lake dwellers used milk and made butter and cheese. It is probable that there were crosses between this shorthorn, known scientifically as *Bos longifrons*, and the larger Urus, then more or less wild.

[1] Morse, E. W. The Ancestry of Domestic Cattle, p. 187. Report of the United States Bureau of Animal Industry, 1910.

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[1] Morse E W The Ancestry of Domestic Cattle p 187 Report of the United States Bureau of Animal Industry 1910

Brown Swiss are likewise excellent milk cattle, while the Red Poll and the Polled Durham are among the dual purpose cows used either for beef or milk.

The husky black and white Holstein Friesian cattle so familiar on our modern dairy farms are of Dutch origin and were first brought to America when the Dutch founded New Netherlands, now New York. There are today more than 11,000,000 of these cattle in the United States, and 1,317,022 of them were registered in 1923. These cows have a tremendous capacity for milking and one of them, the famous "Segis Pieterje Prospect," gave 37,381.4 pounds of milk in a year. This milk contained 1158.95 pounds of fat, in contrast to 1614 pounds of fat given by the shorthorn, Melba, out of her total of 32,522 pounds of milk. Holstein milk is less rich in fat than that of some other breeds, but it is rich enough.

From the Channel Islands near the coast of France have come the lanky Jerseys, sometimes called Alderneys. These yellowish colored cattle were brought to America early in the nineteenth century and have always been favorites in New England, though there are also large herds in Texas and other southern states, among the whole 10,000,000 cattle of this breed in this country. They are popular in Canada and there are numerous herds of them in Great Britain.

The golden Guernsey is another of the notable

Channel Island breeds It comes from an island only 24 square miles in area, and it has been in America since 1830 Today we have about 2,000,000 of these Guernseys, which give excellent high fat milk The Ayrshire, of which there are about 500,000 in this

TABLE 11

AVERAGE COMPOSITION OF MILK OF SEVERAL BREEDS OF COWS*

BREED	WATER	PROTEIN	FAT	LACTOSE	ASH	TOTAL SOLIDS
	per cent	per cent	per cent	per cent	per cent	per cent
Jersey	85 27	3 80	5 14	5 04	0 75	14 73
Guernsey	85 45	3 84	4 98	4 98	0 75	14 55
Ayrshire	87 10	3 34	3 85	5 02	0 96	12 90
Shorthorn	87 43	3 32	3 63	4 89	0 73	12 57
Holstein	88 01	3 15	3 45	4 65	0 68	11 93

* From Fundamentals of Dairy Science p 18 Chemical Catalog Co 1928

country, is of English and Scotch origin and is usually brownish red in color, though often red and white The milk is high in fat content and the Ayrshire is, therefore, often found on dairies producing certified milk

The relative composition of the average milk from various breeds of cattle is shown in table 11

THE GOAT

In many parts of the world the milk of the goat is used for human consumption, just as it has been from time immemorial. Since the goat is a small and fairly docile ruminant it was probably one of the first animals to be domesticated by man. The lake dwellers had goats and they were also among the domestic animals of the ancient Egyptians, the Hebrews, and the Greeks and Romans. In an Egyptian tomb of the time of the Fourth Dynasty, located near the Pyramids of Gizeh, there have been found records showing that the owner of the tomb possessed 220 cows and calves, 834 oxen, 760 asses and colts, 974 sheep, and 2234 goats.[8]

The goat is especially popular as a dairy animal in Italy and Spain, in Latin America, and in various parts of Asia. In Sicily, for instance, the goat is said to be about the only source of milk, and herds of goats are driven through the towns to be milked as near the abode of the customer as possible. Sometimes the unfortunate goat is chased up two or three flights of stairs and milked in the parlor of an important client. Italy and Spain each have about 4,000,000 goats, which is likewise the approximate number in the United States, though a much smaller proportion is employed in this country for milk production.

[8] Pegler, H. S. The Book of the Goat. London, 1886.

Goat farms are gradually becoming well established in certain parts of our Southwest and the industry has been increasing rapidly of late There is, for example, a large goat farm at Dallas, Texas, another near Oklahoma City and several in California The goats raised especially for milking are the pure bred type, descended from Swiss goats imported in 1904, and quite unlike the scrub goats which infest back yards, alleys and vacant lots, browsing on refuse and rubbish and otherwise exhibiting a loss of many of the good characteristics of the well bred goat All modern goats are thought to be descended from the paseng or *Capra aegaprus* of Asia Minor and Persia, but there are now numerous varieties, of which conspicuous representatives are the Swiss Saanen and the Toggenburg, the Anglo Nubian, the Caucasian, and the Aurora of Asia The number of goats in the world probably totals about a billion

As far as milk is concerned the goat is equivalent to about one sixth of a cow and it has often been referred to as the poor man's cow An unusually good milk goat may produce as much as from 5 to 7 quarts of milk a day, though the general average is lower The milk itself resembles cow's milk, except for a slighter higher fat and slightly lower water content The fat of goat's milk is somewhat finer, but the casein is somewhat tougher Goat's milk usually has more of a flavor than does cow's milk, but the aroma

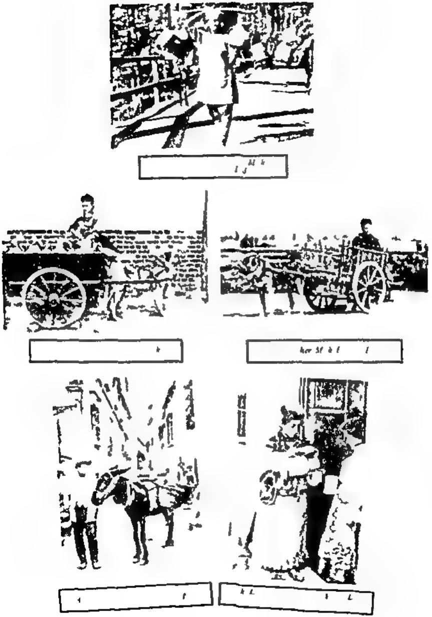
which has come to be associated with goats is attached to the male and not the milk goat

One possible advantage of goat's milk is the fact that the goat enjoys a high immunity to tuberculosis On the other hand, the goat suffers from Malta fever, a disease similar to the contagious abortion of cattle, which is transmissible to man and is known as undulant fever in human beings Malta fever is, however, rare in the United States When all is said and done, goat's milk is, despite claims sometimes made for it, no better and no worse than cow's milk

SHEEP

"Being now awake," says Perdita in the *Winter's Tale* of Shakespeare, "I'll queen it no inch further, but milk my ewes and weep" Although the placid sheep is most often raised for mutton or wool, it also has value as a milker, its milk somewhat resembling that of the goat Sheep's milk makes fine cheese and, as has been stated elsewhere, is the basis of genuine roquefort Several years ago a sheep farm was established in California for the sole purpose of producing milk

Like the goat, the sheep is a regular milk animal in various European countries, such as Italy and the Balkans In Rome in the days of Augustus one wealthy freedman was said by the historian Gibbon to have owned 250,000 sheep and goats Among his



Will m Th mp on

Delivering Milk the World Over

From *Good Health* March 1929

other "cattle" were 3600 oxen and about 4000 slaves the ladies and gentlemen of bondage being classed with the lower animals in those days

In the Netherlands there are pure bred milk sheep which are milked from April to December, giving from 0 2 to 4 4 pounds daily Nearly half of the sheep in Czechoslovakia are used for milk while in Greece cheese is produced almost entirely from some 4,000,000 sheep and 3 000 000 goats [4]

MILK ANIMALS OF THE EAST

Most of the milk supply of India such as it is, is furnished by the humped zebu a sleepy brown or black animal which roams over Asia and parts of Africa The white bulls of the species are revered as sacred by the Hindoos, who call these cattle Brahmans This name has been adopted in place of "zebu" for the few of these cows which have been imported into the Gulf coast region of the United States, where they have been crossed with some of our cattle

In addition to the zebu, which is a real cow, the Orient gets a considerable portion of its milk supply from the tame water buffalo, which ranges over India, the Philippines, and many parts of Asia The wild buffalo is one of the most dangerous of game animals,

[4] Pirtle, T R. History of the Dairy Industry Mojonnier 1926

though no more admired by sportsmen than the great gaur of the tropical East and the magnificent sela dang of the Malay Peninsula This last named is an impressive beast, resembling the Urus in stature, for it looms six feet tall, with wide horns, and has an independent attitude

When buffalo milk is pure and sanitary, which is not often, it is pure white and has a pleasing flavor The cream and butter are also white When it is unsanitary, the milk has a bad odor and flavor The milk is high in fat, ranging from 9 to 14 per cent, with an average, according to one authority,[8] of 11 per cent for the milk of the Chinese buffalo The animal does not suffer from tuberculosis and the milk is quite high in iron There is said to be a family in a village some fifty miles from Canton which has been engaged in the business of buffalo dairying for many generations

The grunting, shaggy yak is still another of the well known milk animals of the East, especially in Mongolia and Thibet The yak, like the water buffalo, belongs to the bison and not the cattle family It gives a rich yellow milk, which travellers report is invariably full of filth when served by the natives In Canada yaks have been crossed with domestic cattle, an experiment somewhat similar to that carried out in

[8] Gibbons, P C. Health and Hygiene in China. *American Medicine* January, 1927

Texas where the American bison has been mated with cattle, the resulting hybrid being known as the "Catalo"

In Arabia and parts of Central Asia the camel joins the group of animals which are important sources of milk. The milk is nutritious, though lower in fat than cow's milk and it seems to agree with the roving Bedouin and the other nomads of the desert, who are vigorous and healthy. The Bedouin diet consists mainly of milk curds from the camel, goat and sheep.

The ugly, ungainly, and more or less stupid camel is one of the world's most useful and necessary animals, both as a beast of burden and as a source of food. There are two types, the Arabian, which in turn has a number of breeds, and the Bactrian, the two humped camel of Asia. The llama of South America is a relative of the camel, and llama cheese is a favorite food in the Cordilleras. At one time, shortly after the Civil War, there was a herd of camels in our own Southwest, imported from the East and now presumably extinct in America, except in circuses and zoos.

Mares and asses have always been sources of milk in various places in the East. The Mongols use this milk today and Kublai Khan kept a huge flock of mares for milking in the thirteenth century. In the eighteenth dynasty of Egypt it was stated on an inscription that certain children "consumed 120 ephahas *of durra, the milk of three cows, fifty*-two goats, nine

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she asses, a hin of balsam, and two jars of oil "[4]. Asses' milk was popular in Roman days and still is employed as a beverage in some parts of the world, mostly in Asia. It resembles human milk more closely than almost any other milk from animals, with the exception of the fat, which is low in asses' milk.

IN THE FROZEN NORTH

In the polar regions and the northern countries where ice and snow are ubiquitous, there are no cattle. Their place and that of the horse, the goat, and the sheep is taken by the reindeer, whose habitat is the boreal region of both hemispheres. The reindeer is the only domesticated species of deer and like the camel of the desert is an important animal in his own lands.

Reindeer milk is very high in fat, averaging about 17 per cent, and it has much less water than other milks. Its lactose is also low. The eskimos use it by freezing a quantity and then melting a portion for consumption as needed. It is not well suited for infant feeding unless greatly modified and thus the natives of Alaska and other northern countries where civilization has penetrated make use of canned milks when they are unable to nurse their babies. Sweet-

[4] McCollum, E. V., and Simmonds, N. The Newer Knowledge of Nutrition (3rd ed.). Macmillan, 1925.

ened condensed milk has the advantage in cold regions of not freezing and it has undoubtedly saved the life of many an eskimo baby

The average composition of the milks of various animals is shown in table 12

TABLE 12

AVERAGE COMPOSITION OF THE MILKS OF VARIOUS ANIMALS*

SPECIES	WATER	CASEIN	ALBUMIN	FAT	LACTOSE	ASH
	per cent	per cent	per cent	per cent	per cent	per cent
Human	87 41	0 91	1 23	3 76	6 29	0 31
Cow	87 27	2 95	0 52	3 66	4 91	0 69
Goat	84 14	3 04	0 99	6 00	5 02	0 81
Sheep	81 90	4 57	1 26	6 52	4 82	0 93
Buffalo	82 14	4 29	0 49	7 44	4 81	0 83
Camel	87 04	3 49	0 40	2 76	5 57	0 74
Horse	90 68	1 27	0 75	1 17	5 77	0 36
Ass	89 88	0 73	1 31	1 50	6 09	0 49
Reindeer	68 2	8 4	2 0	17 1	2 08	1 5

* From Fundamentals of Dairy Science p 17 Chemical Catalog Co 1928

THE TRANSPORTATION OF MILK

A century ago the transportation of milk in this country was generally much less complicated than it has necessarily become today, though even then the securing of the milk supplies of the larger cities involved some problems of delivery A hundred years

ago more families had their own cows and it was a comparatively simple matter to transfer the milk from the cow to the kitchen, or to convey it to neighbors and customers in the vicinity

Today cities are larger and the demand for the most nearly perfect food is much greater The milk supply of a big city may be produced hundreds of miles from the place where it is consumed In 1929 the leading milk company in New York City was getting some of its milk from a source 500 miles away from the metropolis Under modern advanced conditions of transportation, distance does not impose any dangers when proper precautions for the safety of the milk are in operation The modern milk tank car and the motor truck have resulted in reducing the former effects of distance

In many parts of the world, the transportation of milk now causes no more trouble than it did in the pioneer days in America Driving a goat up stairs in a Neapolitan household and milking it in the parlor is a simple enough procedure provided the goat is not too recalcitrant If the customer in Naples is not important enough to merit a goat upstairs or if the milk comes from a wandering cow, too unwieldy for the ascent, a basket containing a convenient receptacle is sometimes lowered from an upper window The milk dealer milks his cow on the spot, fills the

receptacle, which the housewife pulls up in her basket, and then the dealer passes on to his next client [7]

Push carts for the delivery of milk are in vogue in many European cities In Rome one sees small two-wheeled carts carrying milk in metal tanks, insulated with wood A metal chamber filled with ice is suspended from the cover in order to keep the milk cool in transit Similar carts are in use in Holland and Switzerland In the Netherlands the dog, descendant possibly of the famous dog of Flanders, often furnishes the motive power, though not the milk

The bottle pram is a familiar sight in London This is a three wheeled cart, filled with bottles of milk, which are peddled from house to house This system is much more sanitary than that of dipping milk from a large container In the United States dipped milk has been quite generally legislated out of business, though there are still a few backward cities which permit this antiquated and usually dirty method of dispensing milk

In Holland the milk often comes in large containers, but it is drawn off by faucets and not dipped Observers have been impressed with the apparent cleanliness of these supplies A similar system is often found in English communities The bigger

[7] Stocking W A Methods of Delivering Market Milk in Some European Cities *Cornell Countryman* November 1925

European cities, such as London and Paris, employ methods resembling those in the United States.

All kinds of animals, including the human, are employed in the transportation of milk. In China, for instance, a coolie balances a yoke like bar across his shoulders with a pail of buffalo or yak milk hanging from each end. In India milk is often delivered in hollow bamboo trunks, the rings of which are measuring marks. The mule is likewise the milk wagon in many parts of the world, as in Mexico, where in some sections one sees two cans of milk swung across a mule's back, with the driver sitting between them astraddle, thwacking the mule violently on the neck.

A report from Guatemala in 1915 stated that at that time the dairyman was accustomed to drive his cattle from his farm to his place in the city. There the cows were fed and then milked and from this point the milk conveyed about the city either on mules or in small carts. One advantage of such methods is that the milk is fresh when it reaches the consumer, but the possibilities for contamination are great.

In one part of Southern India milk is produced in temples by an order of priesthood. The tribe known as the Todas regard their purveyors of milk as holy men. The chief holy milkman is required to be a bachelor and he is not permitted to leave the dairy temple during his term of office. No one of the common people may defile him by touching him and no

one may even speak to him except on certain designated days He wears a coarse robe and must sleep in the cow house His hand may not touch his mouth while eating, which means that he must throw his food into it, and when drinking the vessel must be distant from his mouth All this may be conducive to holiness, but one suspects that sanitation is considered less sacred, even though cleanliness is reputed to be next to godliness

The concentrated milks have gone all over the world and condensed, evaporated, and powdered milks in cans serve a useful purpose in many parts of the world where dairy cattle are lacking or only sparsely distributed In the large dairy countries such as the Scandinavian, the Netherlands, and the like, only a small amount of concentrated milk is consumed as food, but in the Far East and in Australia and New Zealand the concentrated milks have a wide usefulness This is also true of South and Central America, where a beverage known as "dulce de leche" made of sweetened condensed milk is much in vogue The concentrated milks are likewise found useful on ships, especially for long voyages

MODERN METHODS

The modern milk business has made remarkable progress in the development of efficient methods for the transportation of milk In rural districts and

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small towns, the producer dealer is still occasionally encountered, but milk is nowadays usually produced by farmers who are not in the least concerned with its delivery to the consumer. The man who produces milk and then goes out and delivers it himself is rapidly vanishing.

The householder regards the bottle of milk on his doorstep as a matter of course. Let us, however, trace the various steps between the cow and the consumer. The procedure to be described does not, of course, hold good for the milk from all of the 25,000,000 cows on some 5,000,000 farms in the United States, but is typical of that employed by the large, reputable milk companies in the big cities which vie with one another to produce the most wholesome of foods in the purest form.

The first step obviously takes place on the farm, where the dairy farmer produces milk from healthy, clean cows by means of sanitary methods.[a] On most farms milking is done by hand, the time required for the average cow being from 6 to 8 minutes. In some places milking machines, which imitate the motion of the hands, are employed. Four cups are placed over the four teats of the udder and the milk is drawn through a tube provided with a window into a clean container. The animals are milked at least twice a

[a] See p. 118

day, usually night and morning, and yield on the average from 4 to 6 quarts at each milking, though the amount varies with the breed, condition of the cow, and other factors

The milk is collected direct from the cow into scrupulously clean pails and transferred from them to larger containers, with capacities of from 10 to 40 quarts These large cans, provided with covers, are then taken to the milk house, away from the dairy barn, and kept cool, usually by immersion in ice cold water At a regular time, generally early in the morning the cans of milk, properly protected, are taken by truck to a country milk plant

At this plant the milk is weighed and tested Payment for milk is made on the basis of butter fat and bacterial purity, the better milk of the same weight getting the higher price Any milk which is warmer than 50°F or has too many bacteria, or both, is rejected then and there The farmers are instructed how to produce clean milk and, since it is more profitable to do so, they are eager to attain high standards of purity

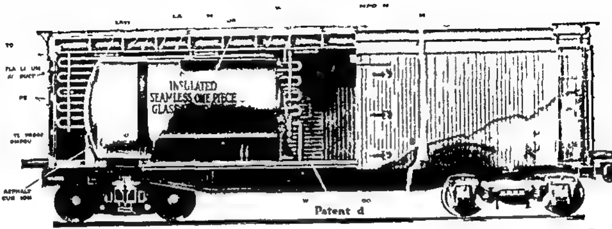
The next step varies according to the practice of different concerns Some bottle the milk and then pasteurize it in the bottle at the country station, some pasteurize it and then bottle it in the station, some ship the raw milk in huge glass tanks, either mounted on motor trucks, or in special railroad cars,

to a plant in the city where it is pasteurized and bottled The use of railroad shipments of milk dates from 1838, when this practice was put into effect for the milk supply of Boston New York did not get milk by rail until 1848

TANK CARS

These huge tank cars are interesting devices constructed especially for the milk trade They resemble an ordinary freight car in appearance, except that they are invariably much more spick and span looking Inside there are two glass lined tanks, insulated with cork and paper and covered with a steel coat The walls of the car itself are also insulated and the interior has a refrigerating system of brine pipes Each tank has a capacity of 3000 gallons of milk, so that the whole car carries 24,000 quarts The milk is kept cold throughout its journey and arrives at its destination fresh and pure The car is taken alongside the city milk plant and the milk removed through sterile pipes into big glass lined storage tanks, where it is held at a low temperature prior to pasteurization

In order to pasteurize the milk, it flows from the storage tanks through sterile pipes, usually being filtered en route, into a battery of glass lined pasteurizing tanks, where it is heated rapidly to from 142° to 145°F and kept at that temperature for 30 minutes It is then quickly cooled by running it through



Cene al Am rican Car Company

Tank Car Now Used for Transporting Milk

tubes covered with brine or flowing cold water All pipes through which the milk flows are made of rustless non-corroding metal, with smooth bends and no pockets These pipes are cleaned daily and sterilized with steam

From the cooler the milk next goes into the bottles, all bottling being done by machine in the large plants, and often in the small ones as well All bottles are washed and sterilized by machinery Each bottle is inspected for defects, then automatically filled by one machine, immediately capped by another, then placed in boxes holding a dozen or so, and passed along to the refrigerator to be held until the skipper of a particular milk wagon is ready to take on his load

The final step is the house to house delivery The horse drawn vehicle is still popular in the milk industry, because of the frequent stops and starts, but motor trucks are also widely used Delivery trucks are now constructed so that they can be operated from the front or either side with a minimum of effort Thus, the driver can jump on either side, depending upon which part of the street he has been delivering

From the time the milk left the cow until the bottle is opened in the home, it has been untouched by human hands, and from the time it was placed in the tank car until it was bottled, it has not even been exposed to the atmosphere There is no question but that a big milk business is an art and a science

The customer is welcome at most plants as a visitor and every patron should go to see the place where the milk he drinks is handled. He may be entertained as well as edified by his visit, and he ought to be satisfied that he is taking no chances with the milk he uses.

In some localities, chiefly large cities, paper containers for milk are now in use. These have the advantages of being much less expensive than glass bottles, of being used only once and then thrown away, and of general convenience and sanitation when properly constructed. On the other hand, milk left in such containers for some time may acquire a flavor from the cardboard, even though it has a protective coating of paraffin or other harmless substances. This coating often cracks when the container is roughly handled and the paper bottle itself is likely to be somewhat fragile. Such containers have been tried in the past by large milk companies, but have been abandoned. It is possible, however, that in an improved form they will solve the important problem as to the best method for bottling market milk for house to house delivery.

By no means are all milk supplies produced and treated in the manner outlined, though it is the usual procedure of the big metropolitan companies. Only the really great concerns can afford million dollar plants, but any concern, whether large or small, can

produce clean and safe milk The man with four cows may do as well as the concern with four thousand, for proper methods are about as important as equipment As a general proposition, city milk shows a higher standard of purity than that delivered in rural sections and small towns, and milk from many cows is more likely to be of good quality than milk from a few

THE WORLD DEMAND FOR MILK

In many countries of the world milk is virtually the national drink It is so in the United States, in spite of the popularity of other beverages, some lawful and some not In our nation the dairy industry has an estimated valuation of about $30,000,000,000 and it is still growing The annual consumption of milk in the United States amounts to about 55 gallons per person, having increased from 43 gallons in 1920

Although milk is deservedly popular in this country, it is even more so in several other nations In all of the Scandinavian countries more whole milk is consumed than in the United States and more is used in Germany or was before the World War, than here According to the figures of the United States Department of Agriculture, the per capita consumption of whole milk in various parts of the world is as shown in table 13

If more recent data were available, it is probable

that an increase in the consumption of milk would be noted for some of these countries In some of them dairy products, such as cheese, are used in quantities, as in Italy, which shows such a low con

TABLE 13

PER CAPITA CONSUMPTION OF MILKS IN VARIOUS PARTS OF THE WORLD*

COUNTRY	YEAR	GALLONS OF MILK CONSUMED PER PERSON PER YEAR
Sweden	1914	69 7
Denmark	1914	68 5
Switzerland	1922	67 0
Germany	1913	61 0
United States	1926	55 3
Great Britain	1922	30 9
Canada	1922	27 3
Hungary	1914	24 3
France	1922	21 5
Spain	1925	13 8
Italy	1913	4 2

* From the Handbook of Dairy Statistics United States Department of Agriculture 1928

sumption of whole milk It seems to be more than a mere coincidence that death rates are in general, lowest in those countries where the consumption of milk and dairy products is greatest

APPENDIX

Selected Bibliography

In order that readers who wish to enlighten themselves more thoroughly on nutrition or dairy science may know what are some authoritative sources of information the following annotated bibliography is presented It includes books which the authors know to be interesting and valuable though there are, of course, many others which it has not been possible to list

GENERAL NUTRITION

Nutrition By Walter H Eddy Ph D 1928 Williams & Wilkins

An excellent popular statement of the modern principles of scientific nutrition written by a recognized authority for the intelligent lay reader

Feeding the Family By Mary Swartz Rose Ph D 1928 (2nd ed) Macmillan

Practical advice on the nutritional needs of the American family and how to care for them

Scientific Nutrition in Infancy and Early Childhood By Stafford McLean M D and Helen L Fales B S 1925 Lea & Febiger

A text book for the medical student and general practitioner and not for the layman It contains valuable advice on infant feeding methods and problems

Short Talks with Young Mothers By Charles G Kerley M D 1926 (8th ed) Putnam

Sensible advice for the layman on infant feeding

Your Weight and How to Control It Edited by Morris Fishbein M D 1927 Doubleday Doran

Scientific methods of dieting presented by a group of experts under competent editorial direction

DAIRY SCIENCE

Fundamentals of Dairy Science By Associates of L A Rogers. 1928 Chemical Catalog Company

A thorough, modern outline of the technical aspects of dairy science presented by a group of experts For the advanced student and research worker, rather than the general public Invaluable as such as a reference book

Dairy Bacteriology By B W Hammer 1928 Wiley

A textbook on bacteriology as applied to dairy products

Cheese By Lucius L Van Slyke, Ph D , and Walter V Price, Ph D 1927 Orange Judd

A textbook for students and dairy workers.

Ice Cream By G D Turnblow and L A Raffetto 1928 Wiley

Modern textbook on ice cream

Lactobacillus Acidophilus By Nicholas Kopeloff, Ph D 1926 Williams & Wilkins

The whole story of acidophilus milk.

Condensed Milk and Milk Powder By Otto F Hunziker 1926 (4th Ed) The Author, La Grange, Ill

Everything pertaining to the concentrated milks A book prepared for factory school and laboratory

Condensed Milk A study of Condensed Evaporated, and Powdered Milk By Atsushi Miyawaki 1928 Wiley

A textbook on the concentrated milks.

History of the Dairy Industry By T R. Pirtle 1926 Mojonnier

Excellent reference book giving the history of, and much useful data on the dairy industry

MISCELLANEOUS

Public Health Law By James A Tobey, LL.B Dr P.H. 1926. Williams & Wilkins

The legal aspects of milk control as well as public health law and administration generally

The National Health Series Edited by the National Health Council 1924 and 1929 Funk & Wagnalls
The whole field of personal and public health covered in twenty three inexpensive pocket size books Additions to the series are planned or in press
Proceedings of the World s Dairy Congresses of 1923 and 1928
These volumes contain much valuable information

The following government departments and voluntary organizations have much valuable material on milk and health
U S Department of Agriculture Washington D C
U S Children s Bureau, Washington D C
U S Bureau of Education Washington D C
U S Public Health Service Washington D C
American Child Health Association New York N Y
American Medical Association Chicago Ill
American Public Health Association New York N Y
American Dry Milk Institute Chicago Ill
Evaporated Milk Association Chicago Ill
International Association of Dairy and Milk Inspectors (see annual proceedings)
National Dairy Council Chicago Ill (and also local dairy councils for list of which see page 164)

Among the national magazines devoted to dairy science or to some phase of it are
American Journal of Public Health New York, N Y
Butter and Cheese Journal Milwaukee Wis
Certified Milk New York N Y
Dairy World, Chicago Ill
Ice Cream Review Milwaukee Wis
Ice Cream Trade Journal New York N Y
Journal of Dairy Science Williams & Wilkins Baltimore Md
Milk Dealer Milwaukee Wis
Milk Plant Monthly Chicago Ill

INDEX OF PROPER NAMES

SUBJECT INDEX

Sans Tache

WAVERLY PRESS INCORPORATED
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BALTIMORE

Sans Tache

IN THE "elder days of art" each artist or craftsman enjoyed the privilege of independent creation He carried through a process of manufacture from beginning to end The scribe of the days before the printing press was such a craftsman So was the printer in the days before the machine process He stood or fell, as a craftsman, by the merit or demerit of his finished product

Modern machine production has added much to the worker's productivity and to his material welfare, but it has deprived him of the old creative distinctiveness His work is merged in the work of the team, and lost sight of as something representing him and his personality

Many hands and minds contribute to the manufacture of a book, in this day of specialization There are seven distinct major processes in the making of a book The type must first be set, by the monotype method, there are two processes, the "keyboarding" of the MS and the casting of the type from the perforated paper rolls thus produced Formulas and other intricate work must be hand set, then the whole brought together ("composed") in its true order, made into pages and forms The results must be checked by proof reading at each stage Then comes the "make ready" and press run and finally the binding into volumes

All of these processes, except that of binding into cloth or leather covers, are carried on under our roof

e motto of the Waverly Press is *Sans Tache* Our ideal is manufacture books "*without blemish*"—worthy books, rthily printed, with worthy typography—books to which shall be proud to attach our imprint, made by craftsmen o are willing to accept open responsibility for their work, d who are entitled to credit for creditable performance

e printing craftsman of today is quite as much a craftsman his predecessor There is quite as much discrimination tween poor work and good We are of the opinion that the lividuality of the worker should not be wholly lost The mbers of our staff who have contributed their skill of hand d brain to this volume are

yboards Stella Kocent Louise Hilpert Mildred Lambert Hannah Scott, ary Franck

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ress Francis Ridenour August Hildebrand Fred Lucker Edward Smith hn Doyle George Lyons Hugh Gardner George Kaiss

FOOD

DIETITIAN, nurse, housewife or anyone whose profession or interest have to do with human nutrition will find these both useful and informative

HYGIENIC FUNDAMENTALS OF FOOD HANDLING by CHARLES THOM and ALBERT C HUNTER It tells in readable language the essential facts about keeping food in an edible state A very practical treatment $3 00

NUTRITION In this book, a distinguished food chemist, DR WALTER H EDDY describes the factors which make food food Particularly interesting treatment of the vitamins $2 50

THE VITAMINS CASIMIR FUNK s (it was Dr Funk who first suggested the term Vitamin) classic and standard work on the subject $5 50

A GUIDE FOR DIABETICS Just what its name implies Compiled by W R CAMPBELL and MAME PORTER Tables of food values, menus and diet lists are included Indicates how monotony of diet may be broken Interleaved with blank pages for personal notes $2 50

FOOD INFECTIONS AND FOOD INTOXICATIONS By SAMUEL REED DAMON A Professional book describing etiology, symptomatology and treatment for the various food infections and poisons $4 00

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